CEREAL SCIENCE today

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AN OFFICIAL PUBLICATION
OF THE
AMERICAN ASSOCIATION
OF CEREAL CHEMISTS

6th Edition

CEREAL LABORATORY METHODS

COMPLETELY REVISED AND REORGANIZED

Any discussion of this world renowned book has to be directed to two separate groups — those unfamiliar with earlier editions and those who regularly use this volume in their laboratory as a standard methods source.

To the former group it should be pointed out that CEREAL LABORATORY METHODS has been published by the American Association of Cereal Chemists since 1922. It represents the work of cereal chemists employed in industrial, academic, and government laboratories throughout the world. It contains the accepted analytical methods used by these chemists for determinations on cereal or cereal by-products.

Former users will be interested in learning that the new 6th edition will be some 40% larger than the 1947 volume and that over 50% of it will be new and/or revised material. The most significant change will be the new style of presentation. No longer will the book be divided into chapters, each concerning a particular subject such as wheat, bread, flour, feed, etc. Instead, the 6th edition will be divided into 100 categories consisting of "determinations" such as the determination of acids, of amylase activity, of calcium, of moisture, of fat, etc. Each of these major categories will be further divided into specific tests.

Many new methods have been included in the 6th edition which were not available in 1947. Among these are methods for the testing of prepared mix ingredients, of physical properties of doughs, of bread staling, etc.

The 6th edition of CEREAL LABORATORY METHODS has been designed for easy use in the laboratory by both the chemist and technician. Ample details are provided for the preparation and standardization of all solutions. Apparatus and equipment are clearly described and special items are accompanied by name of manufacturer. The two separate indices are designed to provide quick access to [illegible] in the book.

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University Farm, St. Paul 1, Minnesota

INSIDE SCIENCE

The Vital Story of Vitamin B_1

(Thiamine)

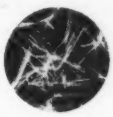
by Science Writer

History. The discovery of vitamin B_1 resulted from research into the cause of beriberi. Almost 50 years passed between Eijkman's discovery of the relationship of the disease to diet and the famous work of Jansen and Donath who first isolated the crystalline vitamin from rice bran.

Within ten years of that first isolation the vitamin's chemical structure was determined and it was successfully synthesized.

Eijkman's work resulted in the development of a theory that beriberi was caused by a lack of some factor in the diet and not by a toxin or infectious agent. This idea was not readily accepted until the growth of dietary knowledge proved it correct.

Isolation and Synthesis. In 1926 Profs. Jansen and Donath accomplished the isolation of crystalline vitamin B_1 from rice bran. In 1931 Windaus and co-workers successfully isolated pure vitamin B_1 and established its empirical formula. In 1936 R. R. Williams, and independently R. Grewe, explained the vitamin's chemical structure. That year, R. R. Williams and J. K. Cline accomplished the synthesis of thiamine which is in wide use today. Andersag and Westphal also synthesized the vitamin in 1936. Another synthesis was described by Bergel and Todd in 1937.



Photomicrograph of B_1 crystals

Chemical and Physical Properties. Thiamine hydrochloride is white, water soluble, with a nut-like, salty taste and yeast-like odor. Its empirical formula is: $C_{12}H_{17}ClN_4OS \cdot HCl$. Thiamine produced by synthesis is identical chemically and in biological activity with that obtained in pure form from nature.

Deficiencies. A deficiency of thiamine is characterized by these symptoms: depression, irritability, fearfulness, lack of initiative and interest, loss of appetite. Symptoms vary since in usual practice deficiencies of other water-soluble vitamins occur. Medical treatment is simple: a sufficient amount of thiamine is administered to relieve symptoms quickly and the physician provides for a continuing adequate intake.

Beriberi victim

A severe deficiency of thiamine leads to beriberi, a serious and sometimes fatal disease. While beriberi is almost a medical curiosity in the United States, it is common in countries in which polished white rice is a staple of the diet.

Human Nutrition Requirements. Thiamine is one of the nutritive elements the human body needs daily and does not store in quantity. The minimum daily requirements established by the U. S. Food and Drug Administration for the prevention of symptoms of thiamine deficiency disease are:

Adults	1.00 mg.	Children (1-5 incl.)	0.50 mg.
Infants	0.25 mg.	Children (6-11 incl.)	0.75 mg.

The Food and Nutrition Board of the National Research Council recommends the following dietary intake of thiamine for healthy persons in the U. S. A.

Recommended Daily Intake in Milligrams

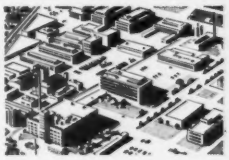
Age	*Men*	*Women*
25	1.6	1.2
45	1.5	1.1
65	1.3	1.0
Pregnant (3rd trimester)		1.5
Lactating		1.5

The Council recommendations for infants and children vary below and above these figures, based on age and sex. Various illnesses and stress situations can exhaust vital reserves of thiamine. So, for the physician, vitamin B_1 is prepared in various dosage forms and potencies for therapeutic and prophylatic use.

How do human beings receive thiamine? It is widely distributed in foods of animal and vegetable origin, particularly cereal grains and dry legumes. Because of public demand for refined products which millers must meet for obvious economic reasons, a loss of thiamine and other factors occurs during processing. The thiamine loss is overcome through the use of *enrichment* in cereal grain products for which Federal Standards exist, or in other foods such as breakfast cereals, by *fortification* or *restoration*. When enriching, fortifying or restoring, the food processor adds the necessary amount of pure thiamine (and other vitamins and minerals) to the food so that the finished product meets Federal, state and territorial requirements or contributes to the consumer an amount of the vitamin which dietary experts believe significantly useful.

Thiamine is extensively used for the enrichment of cereal grain foods such as white flour, white bread and rolls, macaroni products, farina, corn grits and meal, milled white rice. The story of these uses is delightfully told in a separate brochure which is available on request for reference or educational purposes.

Production. Huge production facilities at the Hoffmann-La Roche plant in Nutley, New Jersey, deliver highest quality thiamine *by the tons.* Roche manufactures thiamine hydrochloride and thiamine mononitrate. These fine products, which equal or exceed U.S.P. specifications, are ideal for use by pharmaceutical makers and food processors. Years of experience in research and manufacture have made Roche the leader in vitamins.



This article is published in the interests of pharmaceutical manufacturers, and of food processors who make their good foods better with essential, health-giving vitamin B_1. Reprints of this and others in the series are available on request. Write the Vitamin Division, Hoffmann-La Roche Inc., Nutley 10, New Jersey. In Canada: Hoffmann-La Roche Ltd., 286 St. Paul Street, West; Montreal, Quebec.

THE EXTENSOGRAPH*

has been greatly improved by us:

- All dough dishes and dough clamps are "Teflonized", that is, they are covered with polytetrafluoroethylene. This is a material brought out by the du Pont Company, and its most important characteristic is that nothing will stick to it. Teflon is a very expensive material, costing about $60.00 a pound and the Teflonizing process is very laborious and time-consuming. Nevertheless, we thought that this improvement is worth all it costs.
- The dough trays in the cabinet, which receive the dough dishes during the dough aging, have been improved threefold: They are now made in two parts, which can be quickly disjointed for easy cleaning; they are painted with a water-resistant paint; they have interchangeable canvas inserts, which offer the advantage that the dough will not stick to the canvas, and therefore, will not elongate itself when the dough dish is removed from the tray for testing.
- The dough roll in which the dough is rolled to a sausage, now has a corrugated surface and is also Teflonized, like the dough dishes and dough clamps referred to above. The advantage of both corrugation and Teflonizing is that even sticky doughs will not stick to the surface and will therefore not tear during testing even when a very minimum of dusting flour is used.
- A Teflonized flexible apron is provided for the same dough roll. It is hooked onto the roller housing and the dough is rolled to a sausage or cylinder between the corrugated and Teflonized dough roll, and the Teflonized apron.
- A Teflonized dough positioner is provided, on top of the roller housing, to make certain that each dough ball falls perfectly centered into the dough roll, and to prevent that any dough cylinder comes out lopsided.
- An automatic timer switch is installed, which stops the dough rounder automatically after exactly 20 turns. The advantage of this automatic switch is that each dough receives exactly the same amount of rounding treatment, thus insuring greater uniformity of test results.
- A spindle stop switch is provided, which automatically stops the spindle movement, after its "up" travel is completed, thus relieving the operator of all attention to this while he may be rounding and rolling the dough.
- A chart paper winder is installed at the far end of the recording device upon which the paper will roll itself, thus preventing the chart paper from hanging down and possibly tearing.

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CEREAL SCIENCE today

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COVER: Grain loading at Duluth, Minnesota docks. Photo courtesy General Mills, Inc.

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Editorial

On August 6th of this year, the Manufacturing Chemists' Association announced a nationwide education program designed to encourage more of America's youth to follow a career in science. According to General John E. Hull MCA president, the program will cost an estimated $1,000,000 over a five-year period and will include work at elementary, high school, and college levels. The reasons for this program and others like it have been aired quite extensively in various scientific publications over the past year or two. The crux of the matter is quite simple: too many technical people needed; too few graduates. The MCA estimates that by 1965 the chemical industry alone will be short about 93,000 scientists and engineers. The goal of the MCA program is threefold: 1) To inspire qualified students to follow science as a career; 2) To assist educators through the development of science-teaching aids and "curriculum enrichment" material; 3) To aid and encourage science teachers and education administrators toward the goal of increasing their numbers, their effectiveness, and their prestige.

It is encouraging to note that emphasis is being placed on aid to the science teacher. It is our humble opinion that the most effective means of recruiting a potential scientist is through an enthusiastic instructor. High school science can be interesting and informative if presented in the right manner or it can be an absolute bore. Perhaps many of us can trace our early interest in chemistry to the enthusiasm of one particular science teacher who gave us a little "extra." It didn't have to be much to be appreciated, maybe just the description of an industrial laboratory recently visited or a brief talk by a local chemist. But however small the gesture, it made science alive and real.

Members of the AACC have a wonderful opportunity to make cereal chemistry "alive" and "real" to high school students in the local community. Each member could make it his or her business to meet the science teachers at the neighborhood high school and inquire if they can be of any assistance. Perhaps a short talk or demonstration at an evening meeting of the science club or an invitation to visit the laboratory or plant during working hours. Everything we do to make the teachers aware of our particular specialty will mean "extras" being passed on to the students.

The AACC is acutely aware of the importance of bringing our story, the story of the cereal chemist and the cereal industry, before qualified students and their teachers and advisors. A committee of the Association is at work now preparing a suitable descriptive brochure. It is hoped that all members will supplement this literature with a "personal touch."

R. J. Tarleton

INTRODUCING

the authors

• RAYMOND W. MILLER

Our picture of Raymond W. Miller shows him in a kind of situation where he is thoroughly at home—addressing an audience; in this case, as many readers will observe, the 1956 annual meeting of the A.A.C.C. As to his being at home anywhere *except* on a lecture platform, our efforts to reach him by correspondence since the meetings have left some doubt. He had taken off for Iceland and other places, mainly off the usual travel lanes.

For the briefest mention of Mr. Miller's many positions, the organizations in which he functions and serves humanity, and the distinguished awards he has won, an entire page would not be sufficient. Consultant and lecturer in public relations, with the FAO until recently and now with Harvard's Graduate School of Business Administration; writer in many fields—agricultural, educational, legal, economic, religious, marketing; radio commentator; member of international commissions on food problems, agriculture, and human relations; member of the bar of the U.S. Supreme Court—this listing is merely a glimpse of Mr. Miller's activities.

Lest he seem entirely a will-o'-the-wisp, let's record that he is a Californian, educated at San Jose State College. His permanent residence at Calaveras, Walnut Grove, Linden, California, where his family make their home, actually has a walnut grove which he developed and has operated since 1919.

• G. H. SUGDEN

George Highly Sugden is eminently qualified to discuss wheat conditioning. Since 1934 when he joined Henry Simon Ltd. of Stockport, England, large milling engineering firm, experience and observation have combined to make him thoroughly conversant with the subject.

Before World War II he was Senior Simon Miller in Western Europe and lived in Belgium for several years. After serving with distinction in the Royal Tank Regiment and receiving the Military Cross and Bar, he returned to the company in 1945 as Technical Manager, and was entrusted with the big task of reconstructing many of the war-damaged mills of Europe. He was made a Director of the company in 1949, and since then has personally studied milling conditions in many parts of the world. He is now Joint Managing Director, responsible for over-all direction of the firm's operations.

Mr. Sugden was attracted to a milling career through his family's business in Yorkshire, Thomas Sugden & Son Ltd. Both his father, George Sugden, and his elder brother Richard have played leading parts in affairs of the British Milling Industry.

• C. L. STANFORD

Becoming interested in entomology while attending junior college in California, Mr. Stanford landed a part-time job with the U.S.D.A.'s Bureau, assisting in research on sugarbeet leafhoppers. Other part-time work with the Spreckels Sugar Co. let him put control techniques into practice. Back in his native Mississippi for an interval, he acquired not only the B.S. degree in agriculture from Mississippi State College (1936), but a bride as well. The Stanfords then returned to California for further work with Spreckels.

A new pest causing extensive damage to farm crops in the Gulf Coast areas, the white-fringed beetle, came to Mr. Stanford's attention and he was appointed in 1938 to work on a project for its eradication. He continued with this until July 1955 when he began to work on the Khapra Beetle Control Program as staff assistant at the Oakland, California, headquarters.

THE FINE ART OF HUMAN RELATIONS APPLIED TO

Changing Worldwide Dietary Patterns

By Raymond W. Miller*

NEVER IN MY experience in addressing audiences have I had a privilege such as this — to appear on a program where some seventy scientific authorities are to present papers for their mutual enlightenment and for the benefit of the world. You are the investigators who are creating the basis for future development, for the philosophy and the practice in utilizing carbohydrates as a major essential in the diet of all peoples.

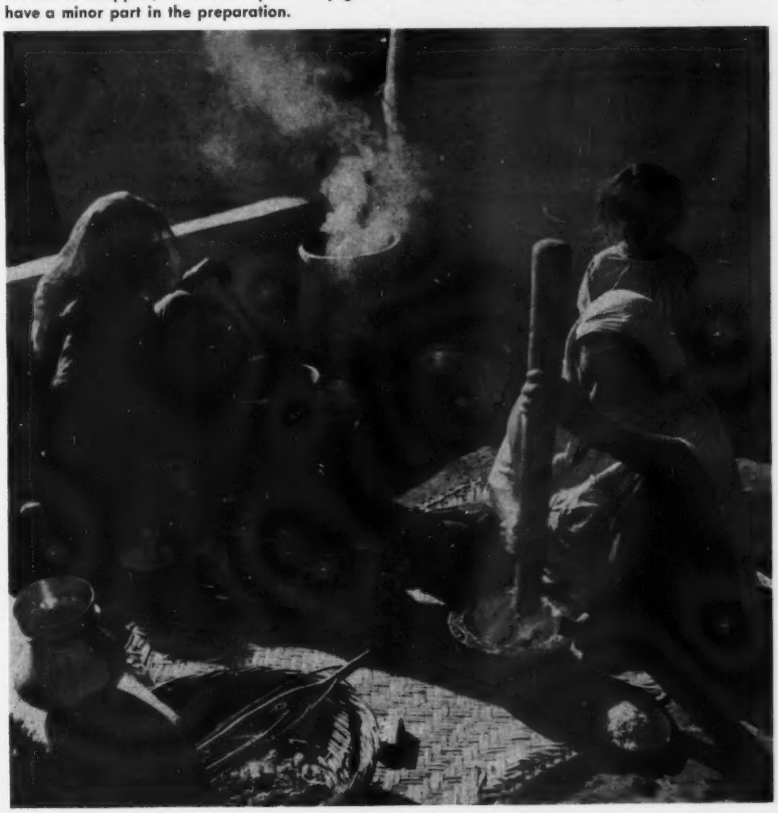
My field is nontechnical. It is in that intangible social area where there is a mixture of facts, fiction, prejudice, emotion, superstition, tradition, inertia, lethargy. "Human relations" is an indefinable phrase. There are on this earth something over two and a half billion people, with a net gain of one person per second. Each of these is a part of the whole intriguing world drama of human relationships. Each makes his own rules, usually following the hoary traditions of his venerable forefathers, and each is slightly, often subconsciously, influenced by the impact of new ideas. You are the scientific plowmen of the Twentieth Century who are uncovering from God's field of knowledge the information that has been here from the beginning of time; but only now, in the wisdom of a benevolent Creator, has it been made available for the use, or abuse, of mankind.

Carbohydrates, proteins, fats, vitamins, and minerals are the food elements that supply the body of man. Only recently have their various individual values begun to be understood, appreciated, and utilized, thanks to the individual and concerted efforts of men such as you. The fact that the values of each of the aforementioned food elements react and are inextricably intermingled with each other and the part they play, singly and in various combinations, in the physiology, biophysics, and biochemistry of human nutrition is comprehended even today by very few people, including scientific people.

Opportunity and Responsibility

Woodrow Wilson, whose 100th birth anniversary we are celebrating this month, once aptly said, "Opportunity is responsibility." Today the scientist and the technically trained layman have the opportunity and the responsibility to "peddle their wares" to the world. The need and the craving for accurate information in the field of nutrition in general, and of cereal chemistry in particular, was never so great as it is today. And today is only a shadow of the demand of tomorrow. Men and women,

By primitive methods and with meager equipment, a woman of the Terai area of India prepares a meal of chappati, to be accompanied by goat's milk. The few modern-looking utensils appear to have a minor part in the preparation.



*Visiting Lecturer, Graduate School of Business Administration, Harvard University. Address given at the 41st annual meeting, New York, May 1956.

boys and girls from the cities and from the places where the creeks fork out in the distant places of the earth are beginning to yearn for the niceties and knowledge of Twentieth Century accomplishments in science, particularly as it affects them *in personam*.

Observations on World Needs

It has been my privilege during the past several years to visit a cross-section of the various countries of the world, and I have come back with a few observations and conclusions which I present today for your thoughtful consideration. Not that they are necessarily entirely true in themselves, but they do represent, to the best of my knowledge and belief, one of the major needs of the world in the field which has been assigned to me today.

Unfortunately, oftentimes knowledge acquired by individuals tends to create in them an attitude of grudging tolerance toward others less fortunate in having access to information. Down through the ages the man of learning too frequently has been the man with a sneer, an apathy, a frown, or perhaps with a mailed fist or even a kick for the person less favored. Science has often failed to indoctrinate its own progeny with the fact that basically all men are human beings, with like reactions to similar stimuli. There has often developed a "caste" of knowledge, and perchance because knowledge has been more available to those of one race than another, there has been a "racial superiority" caste of the knowledgeable race.

Approach through Humility

Bishop Raymond Lane, Superior General of the Maryknoll Order, a few years ago told me of a conclusion he had reached during the years when he was a prisoner of the Chinese. It was that we North Americans and Europeans can live as we do only through the fortunate accident of birth, and that this should make us humble in our approach toward others. "We might have been born elsewhere," he said. "We are the heirs of great work and great suffering by others."

Too often we adopt an attitude of superiority toward our neighbors in other developing countries. We must be modest. Modesty is a great asset in any human relations program. We must realize that the pronoun "I" is the least necessary one, whereas "we" has strength and authority and persuasion. We must remember that as we teach, we also learn; and that we can often gain as much from others as they can from us.

The problem of dealing with improved diets is so complex that it requires special attention and the contribution of a wide range of scientific and technical knowledge and skills. The physical scientist looks down his nose at those working in the less exacting sciences, dealing with matters of culture, economics, and human relations. There must be a blending of knowledge from all of these sources which implies professional tolerance on the part of the physical scientist and a willingness to cooperate more fully with those engaged in the so-called social sciences.

Accepting this thesis, I shall proceed into some of the basic problems confronting us today in the province of human relations involved in changing of dietary patterns.

Man, because of availability of food, or because of custom or other variable factors, has come to eat certain products. Robert West Howard, that indefatigable researcher, coordinator, and writer of scientific and human relations problems, points out that photosynthesis, that never-ending power of the universe that manifests itself in foliage from which cereals spring, is the basis of most of human life. We may eat that foliage directly in the form of wheat or corn, or convert it to beef, poultry, lamb, or pork —or even eggs or milk. Even the existence of the fish in the sea is dependent upon the green scum, just as the higher forms of life are attributa-

Floating "homes" in East Pakistan, where famine imposes a desperate search for food.

Near-starvation may soon be ended for a Punjab refugee farmer and his oxen, as he hopefully plows in the age-old manner for a first sowing in malaria-free earth. The Food and Agriculture Organization of the United Nations and the World Health Organization have worked jointly to free the land from disease. (All photographs were supplied by the Food and Agriculture Organization of the U.N., Washington, D.C.)

ble to the power of the sun through photosynthesis.

Food — An Elemental Human Need

Food is the most universal of all human elemental needs and thoughts. Throw a cordon of troops or barbed wire around this hotel and let this assemblage of well-dressed, well-mannered, well-fed men and women be locked in this room and miss ten consecutive meals, and we would become instinctively as wild animals rather than civilized human beings. The borderline between good behavior and a universal stampede is very thin indeed. It can be measured by a few pounds of food and several pints of water. In emergency circumstances, when supplies of customary food are unavailable for extended periods due to catastrophe or breakdown of supply lines, people at least temporarily instantly change their dietary habits. From these experiences and intimate knowledge of the human-relations approach to food distribution through relief, we can learn much of the development of techniques in home economics and how traditional resistance to dietary changes is overcome. This is a horrible way to gain knowledge, but it should not be overlooked.

To see human starvation is a terrifying experience. When I was in Calcutta in 1949, each evening on the sidewalks surrounding the Great Eastern Hotel, which was my residence, hundreds of people came to sleep under the protection of the awning which shed the torrential rains of the night. And every morning a bullock cart went around the hotel to collect the bodies of those who had died during the night from starvation. Now death from human starvation has largely ceased, owing to the impetus of the work of the Food and Agriculture Organization of the United Nations and other similar specialized agencies of the UN, the missionaries of the churches, the Technical Cooperation Program of the United States with other countries, the Colombo Plan, and the accelerated efforts of the individual nations and peoples concerned. But the problems of hunger and malnutrition are still with us. There is a blessed surplus of food in some parts of the world, and the cursed pangs of hunger in others.

Cereals — Foundation Stone of Diets

Cereals are the foundation stones upon which most of the diets of the world are erected. You are the authorities in the realm of developing uses for carbohydrates. Most of the surplus food products in North America are basically corn or wheat; and with the knowledge which you have in your field, you have parallel responsibility in helping to create new uses for this food—uses that are economically and nutritionally sound and socially universally acceptable. You cereal chemists have one of the greatest opportunities, if not the very greatest, to help mankind move itself one step further up the ladder toward dietary sufficiency. Aside from human distress problems involved in hunger, there is the fact that a hungry man is not a rational individual. The free world is determined to remain free and to protect the souls and bodies of men from the slavery of despotism. But over a period of years millions of people have gone to the other side of the Iron Curtain, many of them simply because they saw only the mirage of food and took it for an oasis.

The easiest course for any one to take is to drift and let time itself solve the problem. Time is too short now for that. Both sides in this battle for the world conscience are playing for keeps. So far we have quite often lost a lot of marbles because we had failed to understand and take into serious account the relative human values involved in the pragmatic application of scientific data.

Scientific Findings Overshadow Human Relations

One of your long-time students and an editor of trends and problems in the food industries, Russell McBride of Washington, recently said: "A chemical equation is not finished and complete until it includes an indication of the energy given off or absorbed *and an indication of the economic and social consequences of gain or loss.*"

Too often we have failed to recognize the fact pointed out by Mr. McBride, that faulty application of new scientific discoveries brings in its trail a misunderstanding of human relations that in many cases may not only undo the benefits of the new way but even cause a revulsion in feeling that delays real progress. Sociology and economics are consanguineous with discovery and invention.

Progress creates problems. This is perhaps the most basic of all neglected rules in the scientific world. When we have certain results from laboratory test tubes and animals, we feel that we can expect man to react as did the mouse, the guinea pig, or the monkey. The fact is that he often will not, because he is a man, whom God has inalienably endowed with the ability to think and power to decide. We speak of old wives' tales—that the tomato is a "poison apple," that citrus juice and milk should not be mixed, and a thousand other superstitions. However, before science can get people to recognize the error of these ancient beliefs, science must itself recognize that it is dealing fundamentally with man as an emotional, reasoning, reacting being and not one merely to be born, to live and die, changing his habits, traits, and stature only after millenniums of time.

An unaccustomed meal for a homeless boy in Khulna, East Pakistan, one of the famine areas.

Scientific knowledge cannot be taken into the home and rolled out like a carpet. Rather it must be applied with a fine brush to a sensitive surface, using what we in North America have come to call the art of "public relations." Basically this is the method whereby scientific progress can be teamed with human understanding. When change was slow there was little need for much consideration of this factor; but in the present age all is different. For centuries man moved (and in much of the world he still does) with the speed of an ox, or perchance the speed of a sailboat. Abraham came out of Ur of the Chaldes at approximately the same speed as U. S. Grant and Robert E. Lee maneuvered their troops along the Mason-Dixon Line. But all is changed and now we even have new models of fast automobiles, many of them apparently designed primarily to match the whims of the ladies who run them.

Stronghold of Custom — The Home

In dealing with people in developing countries, one finds that the application of scientific knowledge to things of a public nature — clothes, houses, contour farming, or transportation — can make reasonably rapid progress; but changing the dietary habits of families is another matter entirely. Meals are eaten mostly in the confines of the home. The home may be a mansion or a cottage, or merely a house of sod, a shack of bamboo, or a cave in the hillside—but here the family eats and sleeps and here customs take precedence over judgment. In Britain it has been common knowledge for many years that undue boiling of vegetables and the peeling of potatoes remove much of the life-giving benefits (the vitamins and minerals) of those foods. However, in too few kitchens have the habits of the centuries been changed. The home may have acquired a central heating unit, but the cookery is still the same. In the United States we know that the whole baked potato is a tasty and nutritious morsel of food and that its mineral-rich skin, coupled with its starchy interior, helps toward a balanced diet; and yet, an examination of the garbage of most any household will find that skins of the potatoes are usually relegated for refuse. Why? Because basically we have failed to translate the findings of science in such a way that they can compete in the highways of human intelligence with a "knowledge" already there, based upon traditions and taboos of the past.

To Help Families Help Themselves

Miss Mena Hogan, Field Agent of the Federal Extension Service, U.S. Department of Agriculture, has worked in many of the nutrition problem areas of the world and has had great success in helping families help themselves to a better living. In a recent address discussing the difficulties faced by Extension Service people in the human relations side of its work, she said:

> "One of our great strengths has been the ability of the county and home demonstration agents to work together, to get along well with people and to get to know all family members. Much of our success, particularly in adult work, has been based on this fact.
>
> "Perhaps this is all the more surprising when you realize that any formal training for your human relations job has been practically nil. You were trained in technical home economics; your county worker, the county agricultural agent, was trained in technical agriculture. Neither of you has had much training in anthropology, sociology, social psychology, psychology or other social sciences that help us to understand our fellow man and to get along with him."

The United Nations' Work

The Food and Agriculture Organization of the United Nations, a cooperative of 71 member governments, recently celebrated in Quebec its Tenth Anniversary. The preamble of its Constitution has as its first objective "raising levels of nutrition and standards of living of the peoples under their respective (national) jurisdictions." It operates on a budget of approximately six million dollars per year and spends some eight million additional dollars through the expanded technical assistance program. It acts as a clearing house and disseminator of information from where it is to where it can be helpful in the application of its prime objective, raising the levels of nutrition.

The applications and work of this organization probably represent the most comprehensive attempt yet made by man to do something of world-wide scope about bettering the nutrition of the multiplying millions of inhabitants of this globe. Its publication, "Teaching better nutrition" (1950), highlighted many important findings in the general field you have assigned me to discuss. Two, among others, are that food and religion are closely associated and that the cultural significance of food is of tremendous significance. A few random paragraphs from that publication are here included, not as covering the whole field, but as a spur to you who are in the basic scientific field, to encourage further study and understanding of the problem of the resistance of people to new information concerning food.

In Anand, Bombay, India, women queue up at the milk cooperative's reception depot to hand in the morning's yield. Each village family owns one or two cows.

How Food Habits Affect Human Behavior

Because of its fundamental role in the struggle for existence, food has acquired a significance in human society, beyond that of providing nourishment for the body, which is reflected in many patterns of human behavior. Food may be closely associated with feelings of security and prestige. It has an important place in many religious observances. It is linked with countless superstitions and prejudices. Thus it can arouse many emotions — pleasure, envy, confidence, and even violent fanaticism. These relationships must be taken into account in attempting to alter food consumption.

Familiar foods give a feeling of security. Conversely, lack of an accustomed food that is associated with order in daily life can cause anxiety and tension. For example, it is said that during the potato famine in Ireland in 1845 and 1846, the Irish people rejected the maize sent from America for their relief and even in some instances starved rather than eat this strange food. Much the same thing has happened when wheat and millet have been given to starving rice-eaters in Asia; and when the Allied Armies imported pea-soup powder into Italy after the Second World War, the hungry population ate it with great reluctance. In a major crisis, familiar food is even more important than in normal times.

Certain kinds of food have acquired a social significance which is quite unrelated to nutritional values. Thus, in many places white bread has more prestige than brown because it was originally more expensive and its consumption was largely restricted to the higher grades of society. For somewhat similar reasons white rice enjoys high social prestige in many rice-eating countries. The roast beef of England has been a symbol of prosperity to the English poor for many centuries, being regarded as food for landowners and rich men.

Dietary restrictions imposed by religion also play an important part in the food habits of many peoples. Mohammedans may not eat pork, most Hindus will not eat beef, and some Hindu communities consume no food of animal origin except milk and milk products, because their religion forbids the taking of life. Some Christian sects also are vegetarian, and others observe weekly fast days on which no meat is eaten. The Jewish religion forbids pork, shellfish, and various other foods, and also prohibits the consumption of meat and dairy products at the same meal. Feeling upon such matters may run very deep. One cause of the so-called Sepoy Mutiny in India (1857-58) was the alleged British practice of using animal fats to grease cartridges, which had to be bitten open by the Sepoys in loading their guns.

Through many generations of observance, religious restrictions have thus eliminated certain foods from the diet of some peoples. On the other hand, religious feasts make an important contribution to normally poor diets in many regions of the world. The Chinese, even when very poor, eat eggs and pork on the traditional festivals of the year and dur-

ing special ceremonies on the occasion of births, deaths, and marriages. Poor Greek families eat lamb at Easter and on Sundays whenever possible, and this is sometimes the only meat which they obtain.

Superstitions and prejudices also influence food habits. In some countries certain foods are believed to have magic properties for good or evil. Eating them, it is believed, may influence the weather or the crops or may drastically affect sexual potency. Such deep-rooted superstitions are hard to alter. Some useful foods, also, are disdained as food for animals rather than for man. In parts of Great Britain, for example, certain green vegetables which used to be eaten by people are now considered "cattle fodder," and Northern Europeans in general have little appetite for maize, which tends to be regarded as "chicken feed." In other words, there are many modern echoes of Dr. Samuel Johnson's scornful definition of oats—"a grain which in England is generally given to horses but in Scotland supports the people." In some countries, also, eating certain animals is felt to be equivalent to eating friends; thus, the horse is not eaten because it is an honored friend of man. An old Chinese peasant refused canned corned beef offered by the American Army because he regarded the ox as a familiar working companion. But in some parts of Asia, dogs are eaten, a practice which would be abhorrent to North Americans.

Other studies of the Food and Agriculture Organization of the United Nations show that a change from rural to urban living tends to create a rapid change in family food habits. The industrialization of communities and greater use of scientific production techniques in agriculture and fisheries have definitely proved that resistance to the changing of food habits can be more easily overcome as economic level increases. But it is important to remember that most people in the developing parts of the world are still poor and have little or no opportunity for choice or change in diet. They normally eat the food which they, their ancestors, and their neighbors have eaten for centuries, because it is a part of the old socio-economic pattern.

Many World Areas Lack Easy Communication

In underdeveloped areas of the world women do not have the means of communication that those of North America enjoy. In the United States and Canada housewives can visit one another with ease through our transport facilities, swap recipes over the telephone, and gain knowledge of food preparation through cookery classes, newspapers, magazines, radio, and television. The woman of North America has become an explorer and adventurer in the field of food. She

A young girl in East Pakistan's famine area.

rushes in where Grandma would have feared to tread, experimenting on ways of pleasing the palate, unafraid to use new foods, and devising new combinations of familiar ones.

In 1943 the National Academy of Sciences published the results of an exhaustive study entitled "The problem of changing food habits" as its Bulletin No. 108. This document, prepared under the chairmanship of Dr. Carl Guthe with Dr. Margaret Mead as Executive Secretary and with the helpful guidance of M. L. Wilson, proved that the problem of changing food habits is not one that can be solved entirely in the laboratory or on the production line. Into the flow of new ideas there must be added the catalyst of sound public relations which makes it possible for men to utilize, with a clear conscience and a free heart, the benefits of scientific discovery. Rejection is the enemy of progress.

Changing Conditions

The *Journal of Home Economics* for February 1956 has as its lead article one by Dean Helen G. Hurd of Rutgers University (College), "Implications of changing social and economic conditions for our educational programs." In the paragraph quoted below she points out some of the basic problems confronting the home economist in meeting the changing conditions of the Twentieth Century:

> Movement from the farm to urban areas, movement out of the cities into fringe areas, dislocation of population, changes in philosophies, changes in family living, new patterns of social organization, changes in education and occupation and income, changes in the nature of social relationships—all are taking place, and all are affecting not only teaching but practically all other professions and businesses. It is apparent to anyone who works with individuals, with social groups, with families, that many of the old formulas do not fit.

Basically, dietary patterns of man change slowly under normal economic conditions. As these conditions change, dietary habits are more easily altered, but even then the process is slower than in other segments of human existence such as clothing, housing, education, and medical attention. Food is the last to change. Medicine and food both suffer from innumerable taboos, superstitions, and prejudices. Because of the urgency of pain, medical attention is much more easily brought to the benefit of mankind than are the results of scientific explorations toward a better diet. However, where attention has been given to combining the emotional aspects of man and his dietary needs, progress has been and will continue to be made. Missionaries to spread the gospel of better nutrition are essential to the effective application of science to humanity.

The political and industrial world has recently come to an increasing appreciation of the part that a comprehensive understanding of human relations plays in the evolution and establishment of new ideas. The pure scientist who "knows what he knows" and knows that what he knows is right is perhaps the slowest of all to accept public and human relations as being necessary to the completion of his job.

Where "Public Relations" Fail

In your field of cereal chemistry some of the most beneficial results of your scientific knowledge have failed to reach people because of the lack of follow-through and of a proper public-relations approach to get people to understand the personal benefits they can derive. People must be taught before they can appreciate. A case in point was the disappointing results of the effort to secure use of Canada Approved Flour even after it was proved by expert scientists that this flour would be of great value for home use as well as in the Canadian Commonwealth Air Forces. But the human relations end sagged, and Canada Approved Flour has almost disappeared from the bakeries and the home. And yet its contribution to the winning of the war was one of the great things which North American cerealists gave to the world.

Cereals a Major Essential in Diets of All Peoples

I have made no attempt today to penetrate the particular problems that you face as cereal chemists, such as protein malnutrition, grain sanitation, or the decline in per-capita consumption of cereals in North America; but may I emphasize that, after visiting many of the distant spots in this changing world, I am sure that the use of cereals as a basis for human existence is not going into permanent decline. Cereals as part of a balanced diet, when properly grown, harvested, warehoused, processed, cooked, and served, offer the greatest and most economic food value to man. Bread *is* the staff of life, trite as it may be to say so. It and its counterparts will continue to be so. You people, as scientists, still have the responsibility of serving the dependent billions of peoples of the earth who are eating and will always eat the product with which you are concerned.

Foundations such as Ford, Rockefeller, and others are performing a great service in widely scattered parts of the world in developing a better understanding and use of scientific knowledge. Typical of what has been learned in this field is the statement made in the following paragraph from an article in the August 19, 1955, issue of *Science* by Dr. J. G. Harrar, entitled "Food for the future":

> Striking improvements in the food supply can be readily made through the application of present knowledge . . . The rapid pace of modern science, both pure and applied, gives promise that future benefits may be much greater than those thus far experienced. Current advances do not signal the end of a technical road, but rather that great scientific developments still lie ahead. If we have the intelligence and wisdom to recognize human responsibilities and to make constructive use of our natural and human resources, we can look forward to a better world in the future and improved standards of living for all.

You, because of your training, education, and dedication are able to uncover more of the secrets in God's field of knowledge whereby cereals can become even more valuable for men. You must recognize that this knowledge can only be made of value beyond the laboratory if it is presented to the consumers of the world with the yeast of intelligent public relations and baked in the oven of sympathetic understanding, and not permitted to be destroyed on the hot coals of intolerance toward those who, although uneducated, have a native intelligence as much entitled to respect as our own.

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CHALLENGE AND OPPORTUNITY IN

New Horizons For The A.A.C.C.

By William H. Cathcart*

THE AMERICAN ASSOCIATION of Cereal Chemists was founded by eleven chemists in Kansas City, Missouri, on May 8, 1915. These men brought into being an Association which I believe will, with the passage of time, prove to be one of the most important scientific groups of food chemists. We are continuously growing and now have more than 1,100 members in the United States, Canada, and other countries. The Association is composed of seventeen Local Sections, two of which, the Chesapeake and the Southern California Sections, became associated with us during the past year.

Our growth has been due to varied factors:

Devoted members giving freely of their time and energies for the advancement of their science;

Our good fortune in having men and women of high caliber as our presidents and other officers, editors, and members of administrative and scientific committees since the Association's beginning;

The desire for greater scientific knowledge and willingness to exchange ideas at meetings such as this, the 41st Annual Meeting, and at local section meetings;

The democratic spirit of cooperation, the experienced always willing to counsel with the inexperienced;

Our journal *Cereal Chemistry*, an unexcelled scientific publication; and

The excellence of our monographs and our methods book, *Cereal Laboratory Methods*.

This year, credit for progress made goes to all of our members; particularly those who have served as your officers, as members of your committees, and as editors of your publications. I deeply appreciate the aid and support I have received from each and every one of you.

Membership in our Association is a privilege and is valued by all of us. The opportunity offered at this meeting to know and exchange ideas with fellow-workers should be ample inducement to make any nonmembers present desire to become active members.

New A.A.C.C. Publications

No scientific organization can be satisfied merely with an increase in membership, but should evaluate its program periodically to see that present needs are met. We have done this, and some changes have been made which we feel will be advantageous. One of these is the publication of a new popular-type journal, *Cereal Science Today*, replacing *Cereal News* and *Transactions*. By now probably you have all seen copies of the first issue. This is a forward step from two standpoints: the economics of the Association, and the need of a publication that can serve as a sounding board for every one of us. Its pages will report everything from Association gossip to news about latest developments in the world of cereal science.

In addition, two popular A.A.C.C. brochures are being prepared for educational use and to promote interest in cereal science outside of our Association. One of the more disturbing conditions that we face today is the dearth of students intending to specialize in cereal science. We may have been lax in encouraging them, but we can no longer pursue such a course. At present, competition for such students is keen. The development of nuclear power and electronics has created many new, well-paying jobs which have an aura of adventure. This, coupled with the great demand for all types of engineers today, has caused students to neglect our field. If we are to interest our share of them, we must act. These two brochures, written in a style intended to appeal to young people, are a beginning. "Careers in Cereal Chemistry," telling what a career in our field can mean, and "The American Association of Cereal Chemists, Its Purposes and Functions," will inform readers about our science and our Association. However, these brochures will be practically worthless unless their messages reach many people, especially science students. Ways and means of effectively placing these publications in the hands of high-school students and faculties, parent-teacher groups, and college students are being studied.

Awakening to New Responsibilities

Yes, fellow members, we have progressed steadily, but we must never reach that point where we are satisfied with the status of our Association or with the extent of our scientific knowledge. We bear a heavy responsibility to society to see that the cereal food supply is not only adequate in quantity and has desirable physical qualities, but that it is nutritionally adequate as well. Perhaps most of us have not thought of our responsibility as being so broad but, never-

*The Great Atlantic & Pacific Tea Company, National Bakery Division, New York 17, N.Y. Presidential address at the 41st annual meeting, New York, May 1956.

theless, it is. We are now entering a new era in cereal chemistry. In the future, changes will have to be made in order that man can feed himself adequately.

It is difficult for us who live in the United States and Canada to envision a time when we might want for food. Our 1955 harvest was almost equal to the record production of 1948. We had more hogs than could be sold profitably. Our granaries contain more corn and wheat than we know what to do with. Our biggest agricultural problem seems to be how not to grow too much. But the Bureau of the Census predicts that by 1975 there will be in the United States more than 200 million people to feed — a 25% increase. There are predictions also that the spreading of drought conditions in our Southwest may limit production.

Cereal Proteins to Increase in Importance

Man's long journey up from the savage state to his present civilization has paralleled the development of cereal grains and the ability to use and store them. This is due to his dependence to a large extent on cereals as food. In many languages, the words for bread and food are synonymous.

In comparatively modern times, improvements in economic conditions, agriculture, distribution, and food preservation have augmented man's diet with many new types of food. Certain of these, such as meat, eggs, and milk, today furnish the basic high-quality proteins for our diet in most of the western world. Inefficiency in producing these protein foods from basic agricultural products, however, can well mean shortages of quality proteins for future enlarged populations. The relentless increase in world population may well force greater dependence on basic agricultural foods and hence on cereal grains as a source of protein. Foods from the oceans and other sources may be developed in the future, but we cannot safely rely on such possibilities. Also, in order to utilize such new foods, the eating habits of people would have to be changed. Thus, we cereal chemists must be prepared for whatever changes future events may bring to our field.

Many peoples of the world have never advanced to the point of depending primarily on meat, milk, and eggs for their protein. In fact, peoples of the world who do not receive adequate protein nutrition numerically outweigh those who have adequate protein. The former Bureau of Human Nutrition and Home Economics of the United States Department of Agriculture has shown that even in the United States considerable numbers of people in the lower income groups, especially in larger family groups, both in large cities and on farms, do not have an adequate quantity of protein. Low-quality proteins supplied by cereal products appear to feature prominently in the diets of children in these groups. Thus, the necessity of nutritionally supplementing the proteins of cereal grains is with us even now.

Amino Acid Supplementation of Cereals

Amino acid supplementation may become a large factor in improving the nutritional value of cereal proteins. It is well known that when a food is deficient in one or more of the nutritionally essential amino acids, the biological value of the protein can be increased by proper amino acid supplementation. For instance, the addition of 0.2% l-lysine (based on flour) to white bread containing 3% nonfat milk solids improves the protein efficiency ratio over the unsupplemented food by 70 to 100%, thus making the quality of the protein of the bread similar to that found in meat, milk, and eggs.

We should thoroughly examine all phases of protein supplementation of cereal foods. There are several possible ways of approaching this. One is fortification with synthetic amino acids; another, breeding varieties with better amino acid balance; another, the use of surplus foods rich in high-quality proteins; and still another, the use of high-quality protein from presently little-used sources such as algae and grasses. However, the use of protein concentrates to fortify cereal proteins may meet objection on the basis that only one or perhaps two amino acids would be needed to balance the cereal protein; the other amino acids in the concentrate would be wasted. Inefficient use of amino acids may not be tolerated in a protein-deficient world.

Supplementation with Other Nutrients

We may, in the next ten to twenty years, have to change our ideas continually as to what constitutes adequate nutritional supplementation of bread and other cereal products. For, if the percentage of bread in the total diet increases we shall probably need to increase the vitamins and minerals and to add other new nutritional factors. Thus, our diet may tend to become more synthetic. By this we do not mean that synthetic sirloin steak will soon be with us, but that more synthetic nutrients may be added to our food. The raising of experimental animals for more than one generation upon completely synthetic diets attests to the efficacy of such a diet. Indeed, today we have "refined" products that are nutritionally equal or superior to "natural" products of the same kind. Consider, for example, enriched white bread, iodized salt, and vitamin A-fortified oleomargarine.

Even today it is necessary to supplement our food to ensure adequate nutrition for certain population minorities. It is likely that in the future we will be forced to make further adjustments in our diet. To maintain a vigorous population, we must concern ourselves with the relatively small proportion of population that needs dietary supplementation.

More Nutritional Facts Needed

There are many factors of diet about which we need to know more. One of the most important is the effect of one food on another when they are eaten together. Knowing the nutritional adequacy of a single food is not sufficient; we must know the nutritional adequacy of the combination of foods that are eaten together. It is well known that the protein and energy available from ingestion of wheat products is decreased as the amount of bran is increased or as the percentage of extraction is increased. It appears now that, if the roughage of the diet is increased with a food such as lettuce, the same effect is observed. Also, we should study the effects of phytic acid in whole grains on the calcium and iron absorption of the diet as a whole and not just from the foods in which it is contained. Adequacy of protein balance, mineral absorption, and vitamin utilization must be considered in the diet as a whole.

Problems in Grain Technology

It is known that part of the wheat berry is better metabolized by domestic animals than by humans. However, fundamental knowledge is needed, from both nutritional and economic viewpoints, as to exactly which portion is best for human nutrition and which for farm animals. Such information will outline for our milling technicians the most suitable division of wheat into flour and feeds. We must continue to review the necessity for adding supplementary vitamins and minerals to the products of our cereal grains so that the best possible nutritional efficiency can be obtained from these grains. Perhaps at this time we should consider the addition of vitamin B_{12} to our cereal foods.

Sanitation problems of cereal grains and products made from them need further investigation. It should be possible to produce cereals free from foreign materials of all kinds. The world's supply could be greatly increased by reducing the quantities lost to insects and rodents.

We must continue to develop improved varieties of grains — those that are resistant to disease and adapted to adverse growing conditions, yet have good performance characteristics. Until now, the growing of wheat has been confined to those geographical areas best suited for its cultivation. This may not be possible in the future, for an increasing demand may require us to grow it in areas not now used.

Research Needed in Baking Technology

We must continue to study all aspects of baking technology, for not only must we provide food that is nutritious, but we must give people food they like to eat. We have pointed out many of the things that will probably be done to improve the nutritional value of bread and cereal foods. We must exert as much, if not greater, effort to improve the flavor and taste of baked products and other cereal foods. In the case of baked products we should give the consumer what is desired in the way of volume, grain, texture, eating properties, and other factors. All types of functional methods and ingredients that affect quality, uniformity, and freshness are basically important and must be thoroughly studied.

New developments and new techniques must be investigated and applied to our science. Rheological factors should be investigated because many aspects of grain utilization depend on them. We must also study further the effect of radiation treatment of cereal foods. We must use radioactive isotopes, i.e., tracer elements, in order that we might better understand the mechanics of fermentation and enzyme action. We should find out if ultrasonics could improve processing methods and products. The effect of mechanical manipulation on doughs needs study.

We particularly need to push forward studies on fermentation. Enzymatic studies to date have not penetrated far enough into the basic problem. The amylases and proteases should be clearly subdivided and the action of each separate enzyme defined. Other enzyme systems in doughs need thorough study. Above all, we must investigate the function of multiple enzyme activity in doughs and the effect of vitamins and trace minerals on multiple enzyme systems.

Chemical stimulators of yeast growth, reaction catalysts, and synergists should be studied. This may well prove to be a fruitful field for fermentation research.

A brief review of the voluminous literature on the oxidation and reduction systems of dough reveals that our knowledge is inadequate. More research is essential for a better understanding of this field.

Bread staling is still basically an unsolved problem. A tremendous amount of work has been done on the problem but we still don't know all that happens when bread stales.

Obligations of Cereal Chemists

Above all, we must study and apply the techniques of creativeness to our problems. All of the things that we must accomplish in the future cannot be left to that spontaneous "flash of genius." Accomplishment must be deliberate — it must be planned — it must be cultivated.

Not only must we be first-rate technical men, but some must learn to be administrators; while all of us must learn to participate and cooperate with management. Whether in industry or in an educational institution, we must contribute toward improving our company or university.

We must do our part toward making the public aware of technical progress. An enlightened public is protected against the quackery which exploits the phrase "chemicals in foods." The public must be made to understand that certain chemical additives in foods are desirable, and that without certain of them our foods would be inferior and in some cases nonexistent. The fact that all chemical compounds intended for use in food are tested thoroughly for toxicity before being used must be widely broadcast. The fact that all natural foods are made up of chemicals must be emphasized so that the word *chemical* can no longer be used by crackpots to belittle certain foods.

Also, we as technicians should see that the public is aware of the importance of bread in a balanced diet and that bread is not a fattening food when used in such a diet.

We must interchange information with colleagues in foreign countries to an even greater extent than in the past. The world is becoming smaller and we are all part of the same world whether we like it or not, and the lack of proper food in one country will affect every other country.

We are now at a new milestone, the 41st Annual Meeting. You will find many of these problems that I have mentioned here discussed at this meeting by experts. Let us all get from this meeting a broader knowledge and a better understanding of the problems that we face in the future. Let us take advantage of every opportunity this meeting offers for the exchange of information with our fellow scientists.

• • •

EDITOR'S NOTE: Dr. Cathcart, past president of the American Association of Cereal Chemists, received the A.B. degree from Indiana University in 1933, the A.M. degree in 1934 and the Ph.D. degree (in chemistry) from New York University in 1936. He directed the laboratory of the American Institute of Baking from 1936 to 1941. Since 1941 he has been director of research for the National Bakery Division of the Great Atlantic & Pacific Tea Co. and is a director of the National Bakery Division.

Dr. Cathcart has contributed numerous scientific papers and technical articles to various scientific journals, including *Cereal Chemistry* and *AACC Transactions.*

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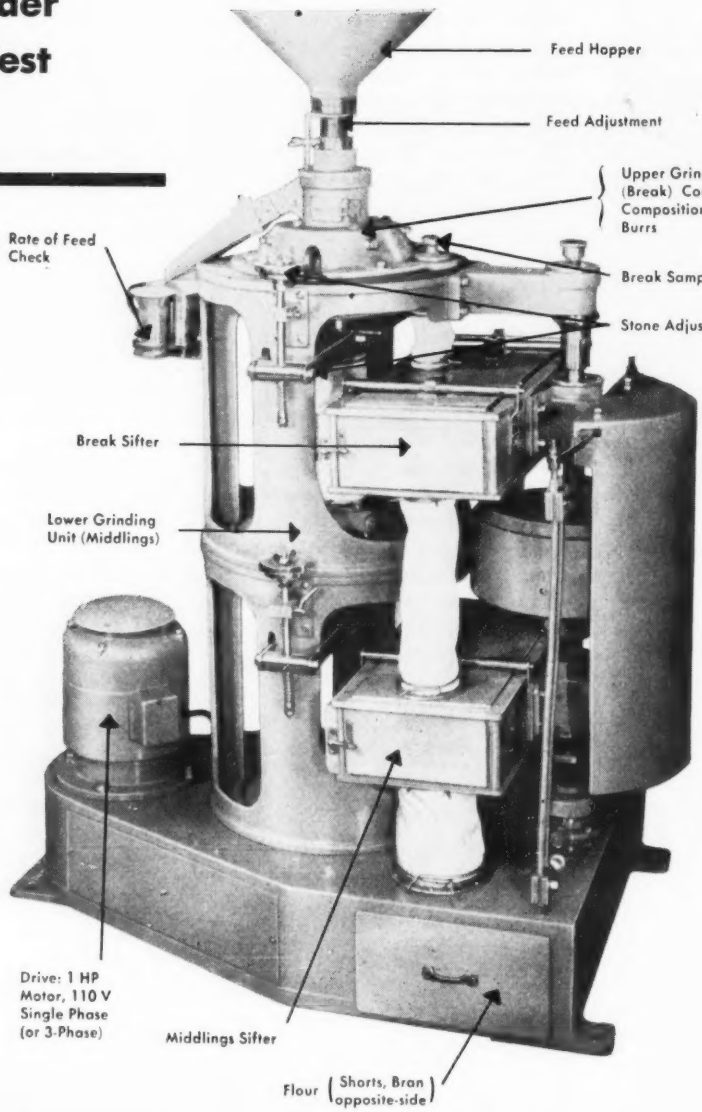

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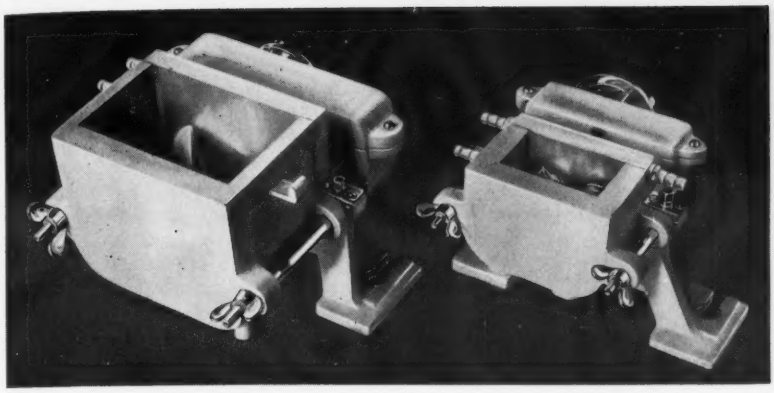

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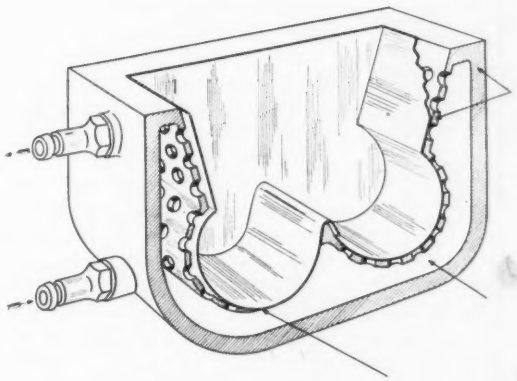

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The Khapra Beetle

By C. L. Stanford*

THE KHAPRA BEETLE *(Trogoderma granarium)* is native to India, Ceylon, and Malaya, where it is considered the most destructive of all storage pests. Closely related to the carpet beetle, it is a member of the family Dermestidae and was first described in 1898. From southeast Asia it has spread to Australia, Korea, Egypt, Germany, England, and other countries of Europe, Africa, and Asia. Beetles discovered in a warehouse at Alpaugh, Tulare County, California, in November 1953 were the first known in the Western Hemisphere.

Soon after the Alpaugh infestation became known, it was learned that the insect may have been present in a warehouse at Fresno, California, as early as 1946, when it was apparently accepted as a common species of Dermestidae. In spite of all control efforts it increased to such proportions that in 1949 over 300 tons of grain in the Fresno warehouse was destroyed. Storage of grain on this property was then discontinued until 1952 as a control measure, but in the meantime used bags were taken from this warehouse to Alpaugh, apparently causing the infestation found there in 1953.

How the infestation reached Fresno is not known; perhaps in bagging used for fish meal or other products from India. In 1954 beetles were found in Arizona, in New Mexico, and in Baja California just across the border from Imperial County, California. All U. S. infestations to date total 79 in Arizona, 223 in California, and four in New Mexico. There are ten in Baja, California.

Life and Habits of the Beetle

The life cycle of the Khapra beetle is completed in from 35 to 100 days, depending on weather conditions. Temperatures of 85° to 90° F. seem optimum for its development, yet larvae have been known to withstand temperatures of 14° F. for short periods of time, and the upper level is considered to be in the vicinity of 115° F.

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EDITOR'S NOTE: *The cosmopolitan tastes, and the difficulty of eradicating or controlling the khapra beetle make it a major threat to the agricultural economy of the nation, particularly in warmer regions.*

Because the pest is strictly one of stored products, the only method of spreading an infestation is through movement of infested material and conveyances. Hence, all railroad cars that have hauled material of any kind from premises later found to be infested are being thoroughly inspected and, when necessary, fumigated, Mr. Stanford reports.

The campaign against the khapra beetle has resulted in general improvement of sanitation practices and conditions.

It should be pointed out that the Millers' National Federation was the first national organization to advocate vigorously that the federal government take an active part in the control program. The Federation should be proud that its survey in late 1954 supplied sufficient evidence to convince the federal government that the states needed help.

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In the larval development of the beetle there are five instars, or different forms assumed between successive moults. The cast skin is shed following each instar. The female, during its lifetime, lays an average of 120 eggs. Adults live but a short time, and apparently do not feed.

Unlike most Dermestidae, the khapra beetle prefers starchy plant materials to food of animal origin, and attacks all grains and grain products. Damage to grain, depending upon existing conditions, varies from about 5% to 30%, but amounts up to 75% have been reported. Whole grain or seed is attacked only by fourth-instar or older larvae; young larvae feed on debris or damaged kernels. They are dirty feeders, breaking or powdering more kernels than they consume. (See illustration.)

In this country the beetle has been found in unprocessed materials such as black-eyed peas, sorghum, barley, soybeans, peanuts, corn, pinto beans, oats, wheat, alfalfa seed, castor beans, and cottonseed. Preferred processed materials include corn meal, rolled oats, flour, bread, breakfast cereals, crackers, dog biscuits, powdered milk, raisins, and nutmeats. Bulk grain under extended storage is its most favorable environment for multiplication and consequent damage.

Economic Significance

The economic significance of this pest is all too readily apparent: in 1954 the total annual farm value of agricultural commodities which have been described as suitable host material for the khapra beetle amounted, in California alone, to 221 million dollars, or about 10 per cent of the state's total agricultural production for that year.

Control costs are high, of course, since it is the most difficult to control of all storage pests. Also to be reckoned with are commodity treatment costs imposed by quarantine action, and possible effects of trade boycotts.

Control Measures

As a result of a public hearing held in Denver, Colorado, on Decem-

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ber 1, 1954, a Federal Domestic Quarantine was instituted to assist in preventing further spread of the beetle. Intrastate quarantines by affected states, paralleling the Federal regulations, control the movement of all susceptible material from infested properties.

Measures that are effective against most storage pests have been found nearly useless with the khapra beetle. Spraying apparently does not reach all of the larvae in the incredibly minute crevices in which they find it possible to hide. Since they also live for extended periods without food, nothing short of a penetrating fumigant could be expected to prevail, and then only by covering the building with gastight tarpaulins so as to fumigate both the interior and exterior portions of the structure. Complete eradication is the ultimate aim.

The fumigant used is methyl bromide, applied initially at the rate of 5 pounds per 1000 cubic feet, for 48 hours. In one fumigation, over 16 tons of gas were used. To speed the diffusion of gas with the air in the building, the methyl bromide liquid is heated in hot-water jackets as it leaves the cylinders.

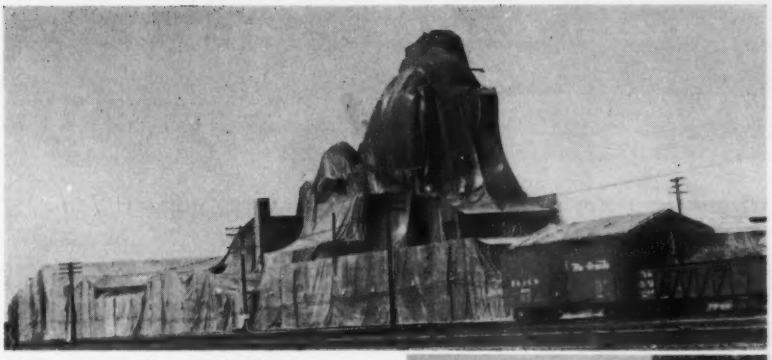
Buildings must, of course, be completely covered with tarpaulins. The largest establishment so far fumigated required 9½ acres of tarps.

To extend coverage for tall storage tanks such as those shown on page 135, edges of the tarps are rolled together and clamped with heavy spring clamps.

Wind is a constant threat to fumigation and sandbags are used to help hold tarps and prevent whipping. after the photograph was taken (top of page 135), ropes had to be secured around the tower (center of the photograph) to prevent billowing before the gas was admitted.

As another measure against wind force, air inside the building must sometimes be evacuated. The volume removed is measured, and the amount of methyl bromide required to raise the concentration is added.

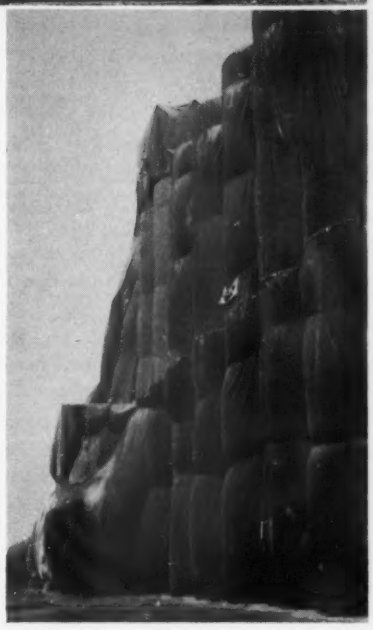
The concentration of gas in the building must remain at 32 ounces or above for at least 24 hours. Concentrations are sampled from selected locations throughout the structure at intervals of 2, 4, 6, 12, 18, 24, 36, and 48 hours, by means of probes attached to neoprene tubing, through which gas is drawn to a thermoconductivity analyzer.



Sandbags are used to help hold tarps to prevent whipping. Here, ropes were later secured around the tower to prevent billowing before gas was admitted.

Of 306 properties found infested in the United States, involving 81,243,671 cubic feet, 132 (54,364,923 cubic feet) have been fumigated and released from quarantine.

It is entirely within the realm of possibility that the khapra beetle can be eradicated from the North American continent, as a result of the techniques now in use. The process will be long and difficult, and much survey will be needed to determine that the last infestation has been discovered and dealt with. However, if all existing infestations can be found and further spread can be restricted during the period of the attempt, the goal of complete eradication should be realized.



To cover tall storage tanks, tarpaulins are rolled together and clamped with spring clamps.

Larvae and cast skins of the Khapra beetle in corn, showing extreme destructiveness. Only fourth-instar and older larvae are capable of attacking sound grain.

VARIOUS ASPECTS OF WHEAT CONDITIONING[1]

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THE MAIN OBJECT of conditioning is to bring wheat into the best physical state to suit the milling process. Wheat can be milled best when it is just damp enough so that the endosperm crumbles easily and the bran does not, yet dry enough for the endosperm to come away easily from the bran, and for stocks to be lively and easy to sift. Unfortunately, these physical properties of wheat cannot all be attained at one ideal moisture content, and the miller must make the compromise that suits his purpose best, taking into account the nature of the wheat, the extraction rate, and the use that is to be made of the mill products.

Wheats milled in Europe are from many different sources and vary widely in character. After they have all been brought as near as possible to one uniform milling condition, they must be blended in skillfully chosen proportions. If this is not done, endosperms will offer different degrees of resistance to the reduction rolls; those that break up most readily will be reduced first and will form too large a proportion of the flour yield from the early reductions; and the more resistant endosperms will form too large a proportion of the flours from the later reductions. This upsetting of the blend at various stages of reduction is particularly undesirable where flour from the early reductions is packed separately and sold at a higher price as a high-grade commodity. If the harder wheats are not fully represented in high-grade flours, baking quality will be inferior.

The following moisture contents have been found best for milling four popular wheats under European conditions: soft European, 15.0–15.5%; Australian, 15.5–16.0%; Plate, 16.5–17.5%; and Manitoba, 18.0–19.0%.

Moisture Considerations

If extraction rate is to be low, flour quality must be high, and bran must be kept out of the flour at all costs. Thus, for toughening the bran and reducing the production of bran powder it is better to use a high moisture content, even though it may make the endosperm harder to detach from the bran.

If extraction rate is to be high, a lower moisture content is preferable, for in this case the important consideration is that the endosperm shall be easy to detach from the bran; in making it so, the production of more bran powder must be accepted.

The miller must consider several other factors as well. How much moisture will be accepted in his final products? The moisture content at the first break is between 0.5 and 1.5% greater than that of the final flour, depending on climatic conditions, on the nature of the plant, and on what the actual moisture content was originally. If storing qualities are especially important — as in hot climates overseas or for war emergency stocks — the moisture content of the wheat must be limited accordingly, unless the flour is dried after milling. What are the possible effects on flour granularity, water absorption, and general handling properties in the bakehouse resulting from any alteration to conditioning methods and moisture content of the flour?

There is sometimes a second object in conditioning, i.e., stabilization of gluten. Wheat with gluten that is weak and overextensible may with advantage be treated for an appropriate period with heat and moisture so as to improve strength without too great loss of extensibility. This is of great importance where chemical treatment is not allowed, and particularly in those countries of Europe where a large percentage of home-grown wheat is used. However, even where chemical treatment is permitted, there are occasions when modification of the gluten characteristics by heat-treatment can be beneficial.

Conditioning Requirements

To attain the most desirable moisture content in many different wheats, the miller must be able both to add and to extract moisture. Drying is of great importance in countries like Denmark and Sweden where the mill may have to handle a domestic wheat containing as much as 20% moisture, which must generally be reduced to 15% or even lower if the wheat is washed before milling. There is a tendency to grow more wheat in European countries so as to save expenditure of foreign currency, and combine harvesters are being used more; as these machines result in wheat being delivered to the miller at higher moisture content, drying machinery is becoming an indispensable feature of most European mills. Imported wheat, on the other hand, is usually hard and dry, and its moisture content must be considerably increased before it is milled.

The processes which may be involved in conditioning are drying, tempering, and toughening of the bran. Drying is normally carried out by hot-water radiators or by hot air. Added moisture is distributed in the tempering process, either by binning the previously damped wheat for possibly several days — the process of cold-condition-

[1] Reprinted from a report of the Congress of the Norwegian Cereal Chemists' Association, held in Bergen, Norway, in 1950.

ing — or by bringing the wheat to a high temperature for an appropriate time, as in warm-conditioning. The bran is sometimes toughened by adding a small amount of water to the wheat after the main process of tempering has been completed, so that the bran is left slightly moister than the endosperm. This addition of moisture counteracts the tendency toward overdrying of the bran by the air that is used to cool the wheat at the end of the warm-conditioning process.

Where gluten is to be stabilized by heat treatment, plant must be provided or adapted to bring the wheat to a higher temperature than is used in warm-conditioning and to keep it at this temperature for a suitable time. The temperature and time required depend considerably on the moisture content of the wheat.

Experiments on Moisture Penetration

An understanding of how the wheat grain absorbs water is a valuable help to designers of conditioning processes, and scientists in many countries have made close studies of the subject. The temperature of the grain has a great effect on the rate of drying. Table I shows how increases in temperature increase the drying effect of air currents on two kinds of wheat. Both the red and the white wheat lost more than twice as much moisture when the temperature of the drying air was raised from atmospheric to 80°C.

TABLE I
INCREASE IN DRYING EFFECT OF AIR CURRENTS ON TWO KINDS OF WHEAT, CAUSED BY INCREASES IN TEMPERATURE

SAMPLE NO.	TEMPERATURE OF AIR CURRENT	DRYING TIME (APPROX.)	FINAL MOISTURE
	°C.	hours	%
	Red wheat — initial moisture 21.4%		
1	(Atmospheric)	10	15.2
2	40	2	14.7
3	50	2	12.6
4	60	2	10.6
5	70	2	9.2
6	80	2	7.9
	White wheat — initial moisture 22.0%		
1	(Atmospheric)	10	16.1
2	40	2	16.1
3	50	2	15.3
4	60	2	10.8
5	70	2	9.8
6	80	2	9.1

A number of people have studied in detail the rate at which moisture penetrates into the central parts of the grain and the path taken by the main proportion of the moisture.

We should expect that water would enter into a compact structure such as a wheat grain, either by filling voids and cracks in the grain in much the same way that water soaks into blotting paper, or by the much slower process of diffusion through the solid membranes and masses of the grain — or perhaps by both of these processes. When wheat grains are immersed in water the absorption process has in fact two such distinct phases. A considerable amount of water is picked up in the first minute and is retained in the outer layers of the bran and in the region of the germ. This rapid initial pickup is followed by a very much slower absorption of moisture. Curve A of Fig. 1 shows the rate of increase of moisture in a sample of Manitoba wheat at various times during immersion.

It is estimated that there is a rapid initial take-up of moisture equal to about 4% of the weight of the grain, and that this is held by the outer layers of the bran only. There is little difference in the amount of water taken up when the wheat is immersed for 30 or for 60 seconds, in cold or warm water. This estimate was made when surplus water had been removed, either by blotting the surface of the grain, or by light centrifuging. Commercial washers and "whizzers" (centrifuges) add considerably less than 4% moisture to wheat; the small amount is probably due to the delay in application of centrifugal force after removal from the water in laboratory tests.

Water penetrates very slowly into the interior of the grain on standing, owing to the comparative impenetrability of one of the bran layers. At ordinary temperatures, wheat immersed in water takes a long time to become fully saturated, the later stages of absorption becoming slower and slower; final moisture content is about 40%. The extent of this maximum absorption is not affected by even great variations in temperature, but the time to

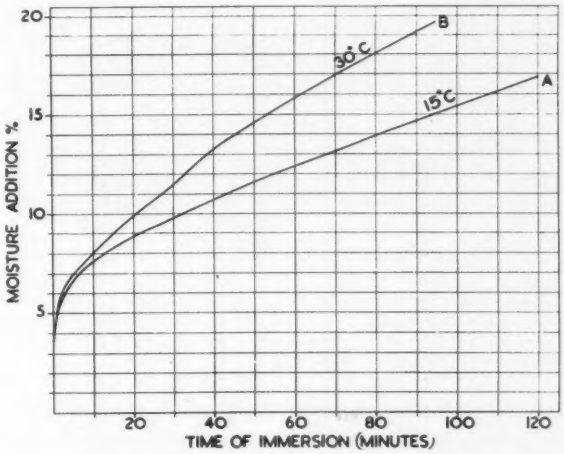


Fig. 1. Rate of absorption of water by immersed wheat.

reach saturation is greatly affected by variation in temperature. At room temperature the process takes 2 to 3 days; at 30°C., 24 hours; at 40°C., 8 hours; at 60°C., 2 hours; at 80°C., only 40 minutes. This is shown in Fig. 1 at 15° and 30°C.

Curves that show the rate of moisture absorption in the grain give no information about the path that the moisture takes. The wheat grain is small and complicated and there are few methods available for studying in detail the moisture concentration at points inside it. It is useless, for example, to soak grain in colored solutions, since most of the dye will be taken up and held firmly by the outer coats and adjacent material, and the water in which it was dissolved will be free to penetrate.

However, a Russian experimenter, Ugrimoff, working in Paris, developed an interesting and ingenious technique for mapping the progress and path of the moisture inside grains that are immersed continually in water. This meth-

od depends on the fact that starch is stained by iodine vapor, the nature and intensity of the stain depending on the moisture content of the material. If the moisture content does not exceed 12.3%, the exposed endosperm of wheat is colored yellow. At 18%, the color becomes brown with an increasing suggestion of gray or lilac. At and above 22% moisture content, the endosperm is stained a dark lilac (Fig. 2, A).

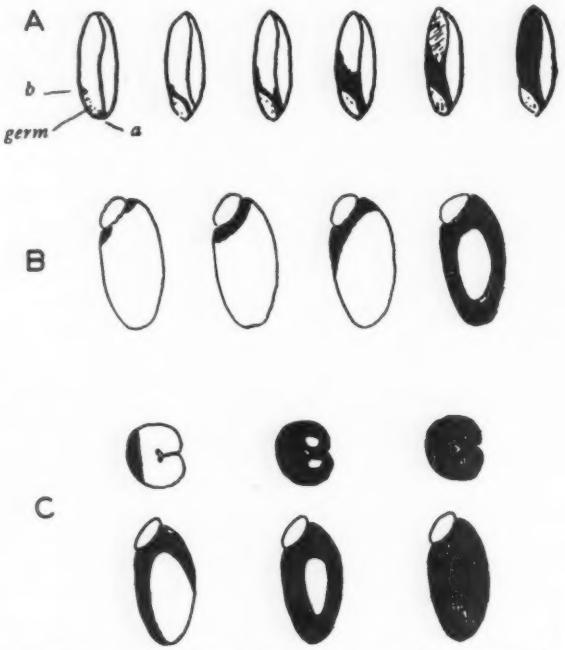


Fig. 2. Penetration of water into wheat grain, after immersion for various periods and at different temperatures. A, after 1½, 3, 4, 5½, 7, and 9 hours respectively. B, after 20, 40, 60, and 90 minutes, respectively (45°C.). C, cross section and side views of the same grain after 30, 50, and 70 minutes respectively (60°C.).

Individual grains are removed from the water after being soaked for various periods and a section is cut through each grain. After the cut faces have been exposed to iodine vapor, the extent to which water has penetrated in various directions inside the grain can be seen. In Fig. 2, B and C illustrate the course of penetration of water into these totally immersed grains.*

At ordinary temperatures water passes very slowly through the bran and through the endosperm, but there is a narrow region of bran, forming a ring around the germ, through which water passes comparatively rapidly into the endosperm. The germ itself, as would be expected, takes up relatively large amounts of water, even double that of the grain as a whole after immersion for 30 minutes. This water cannot be transmitted directly through the scutellum to the endosperm, or if at all, only with extreme slowness. The water enters primarily and most rapidly through the bran around the germ.

Moisture tests carried out after different periods of immersion on the two halves of the cut grain show that after 1 hour's immersion the moisture contents were 11.5% at the beard end and 13% at the germ end (with germ removed); after 6 hours' immersion these two figures were 18% and 24% respectively. Even after 24 hours' immersion at ordinary room temperature, the moisture contents of the two ends had not become equal.

At raised temperatures there is more rapid equalization of the moisture percentage of the two halves, and the higher the temperature the more rapid becomes the equalization. Thus with a short period of immersion followed by 30 minutes' standing at 50°C. the difference in moisture content was about 0.3% to 0.4%, much the same as after 15 hours' standing at room temperature.

Wheat immersed in water at the beard end only will not germinate, since water does not pass from the immersed wet beard end along the bran to the drier germ end. Although the water will not pass along the bran from one end of the grain to the other, it will pass more or less slowly through the bran, according to the temperature.

It follows that the hastening, by increases in temperature, of the equalization of the moisture content in the two halves of the grain is due to penetration of water through the endosperm. Although the passage of water through the endosperm is by no means rapid, it is much faster than the transmission through the bran. It is, therefore, primarily the difficulty of penetrating the bran which makes immersed wheat so slow to absorb water at ordinary temperatures.

The movement of water is in general rather more rapid through the endosperm at the back of the grain (opposite to the crease), and in many cases much slower through the endosperm situated in the cheeks.

Examination of a large number of grains shows that broadly the general behavior of all wheats is the same.

Temperature vs. Penetration Rate

An examination of the influence of temperature on the rate of penetration of water through the bran shows that as the temperature is raised, the speeds of penetration of the water *both through the endosperm and through the bran* are increased to a marked extent. The local peculiarity in the bran near the germ becomes, in consequence, of relatively much less account; penetration is much more nearly uniform at all points, although it still seems to occur more readily through the back (dorsal region) of the grain than through the cheeks.

At these high temperatures (45° and 60°C.) a phenomenon is observed that does not appear when the grain is soaked at room temperatures. The parts of the endosperm which remain pale on exposure to iodine vapor and are, therefore, still of comparatively low moisture content (i.e., incoming water has not yet reached them in any considerable concentration) are yet modified. They look vitreous and hard, but when the section is scraped lightly, or even cut, they readily assume a starchy appearance and pulverize; that is, the endosperm so affected is *mellowed*. This process of mellowing is dependent on the

* Both of these diagrams and much of my information are from unpublished work of Dr. C. R. Jones, Research Association of British Flour Millers, whose permission I have to discuss it.

presence of moisture, but, since it does not occur in the cold, *is much more dependent on temperature.*

The course of mellowing appears to follow the course of moisture penetration; it occurs first and most readily in the endosperm at the back of the grain, and appears last in the endosperm of the cheeks.

The bran consists of four layers. Within the innermost of these is the testa and within this again is the hyaline or nucellar layer. Then comes the relatively thick aleurone layer and within that is the endosperm. The hyaline layer, immediately outside the aleurone layer and sixth from the outside, appears to be the relatively impermeable "mackintosh" layer which at ordinary temperature protects the interior of the grain from too sudden an inrush of water. The hyaline ceases near the rim of the germ, the latter being covered only by the testa and outer layers of the shell proper.

A further conclusion may be drawn. After the addition of water to wheat, the water held by the bran coat in the vicinity of the germ quickly penetrates the interior near the germ. If the wheat is then kept at ordinary temperatures, the water held by the bran is largely passed on to the endosperm — quickly near the germ, very slowly elsewhere, and more slowly in the cheeks than along the back of the grain. In addition to this movement everywhere from the outer coats toward the central endosperm, there also ensues a longitudinal movement through the endosperm from the germ end toward the beard.

The processes of transmission through the inner bran and of penetration through the endosperm are enormously accelerated by the rise in temperature; while many hours or even days are required for even distribution of the added moisture at room temperature, say 15° C., a matter of minutes suffices at, say, 60° C.

Increased temperature also has an effect in increasing the friability or mellowness of the endosperm. This increased mellowness is due more to increased temperature than to increased water content, since it does not appear to take place, at least to anything like the same extent, at ordinary temperatures.

Short-Conditioning

The manner of absorption of water into the grains and the mellowing effect of heat have been demonstrated photographically and described in some recent work by Hopf in Germany. Individual wheat grains were treated for the temperatures and times normally used in a new short-conditioning process. To determine the effect and penetration of this form of conditioning, a steam jet was directed at the dorsal side only of the wheat grain, the other side remaining untreated. Cross-sections of the grain and various portions of the bran skin were then examined microscopically and photographed to determine the effect of this treatment. Vitreous red German wheat was used in each case.

Figure 3, upper, gives an outside view of a grain conditioned from the dorsal face, left, and an unconditioned grain, right. The treated grain shows a lighter color of bran skin, whereas the color of the two grains was the same before conditioning. Figure 3, lower, shows cross-sections of the same grains. On the left, where the steam jet was directed at the dorsal face, a white opaque surface stretches from the back of the grain as far as the crease. The endosperm in the area of the cheeks, however, is still vitreous and apparently unconditioned.

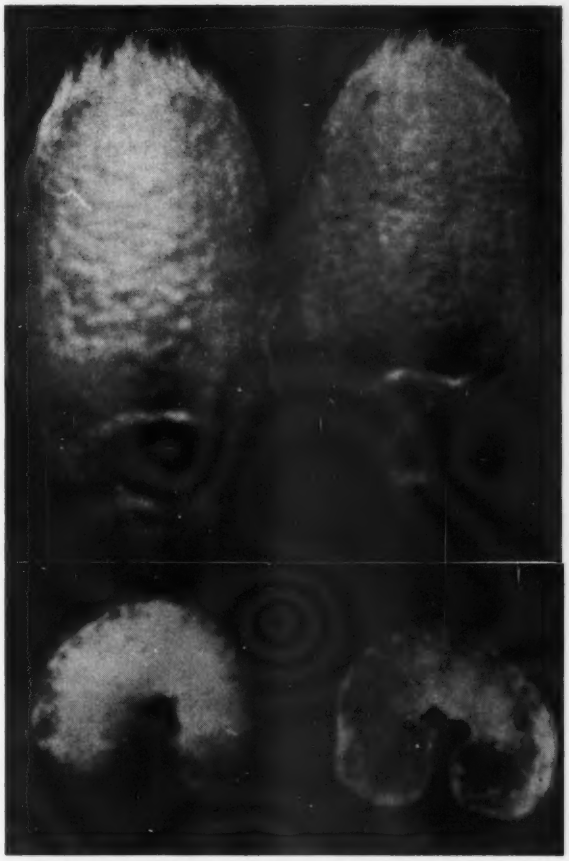


Fig. 3. Upper: Outside view of a grain from the dorsal side. Left, short-conditioned by steam jet; right, unconditioned. Lower: Cross-sections of the same grains.

Again in Fig. 3, the treated grain, left, shows considerable difference in the germ itself. Hopf concludes, from this, that as the inner bran skin is relatively impermeable, a large quantity of moisture must have been absorbed through the area of the germ, and this explains the large opaque area in the cross-section of this grain (Fig. 3, lower). The conclusion is, therefore, that two factors operate in the case of short-conditioning: the endosperm is affected both through the bran skins and from the germ, but the latter influence is much greater.

Figure 4 shows the way in which the bran skins have become detached from the endosperm in the immediate area of the steam jet. The separation occurs between the inner bran skin and the aleurone layer.

In tests of this sort it is always possible that the results are affected by the way in which the grains are cut and photographed. Nevertheless, these tests apparently con-

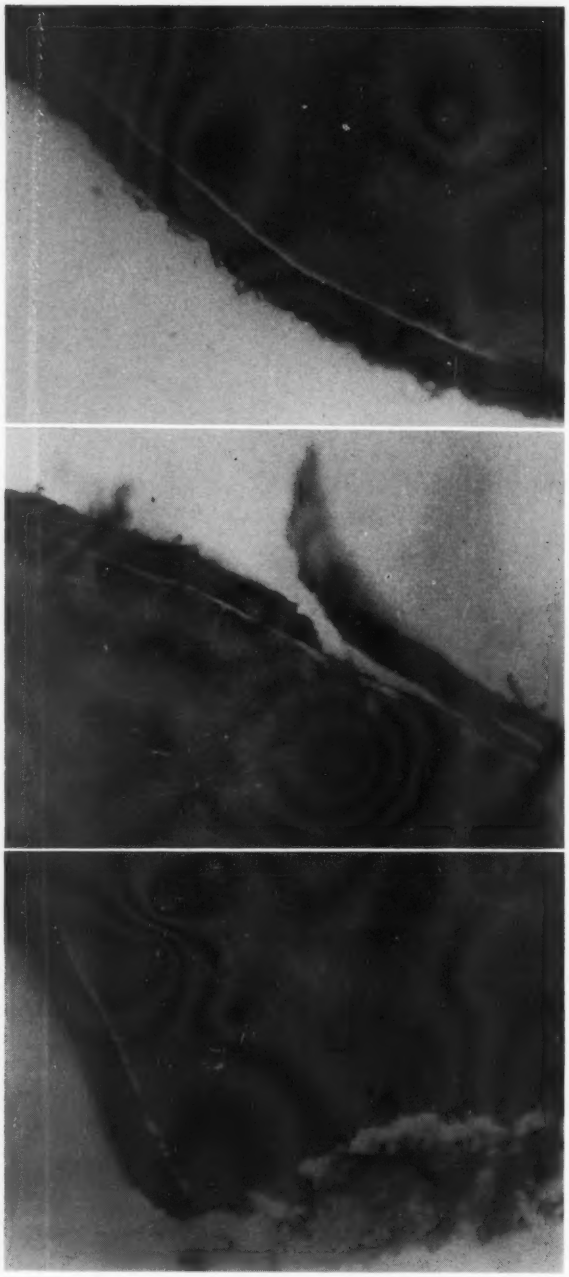


Fig. 4. Showing bran skins detached from endosperm of short-conditioned wheat grains. (Cross sections, highly magnified.)

firm previous work on moisture penetration into the wheat grain and support the claim that directly injected steam facilitates separation of the bran from the endosperm. In this method of conditioning it is sometimes possible to find individual grains in which a definite separation between the bran skin and the endosperm can be seen with the naked eye.

Conditioners consisting of hot-air or hot-water radiator machines were a considerable improvement over previous methods, which consisted of damping hard wheats to increase their moisture and binning soft wheats with a harder variety to remove some excess moisture. Conditioning processes used until recently are, however, long and difficult to control. Consequently, wheat condition is still considerably influenced by variations in weather; moreover, the exterior of the wheat becomes too dry for good milling when cooled by large quantities of air. In gluten stabilization, accurate control is difficult owing to the large quantity of wheat in the conditioner, the long time factor involved, and the difficulty of giving each grain identical treatment.

"Stabilisor" Conditioning

To obviate these difficulties, a new short-conditioning process has been developed, using a machine known as a "Stabilisor." Passing through the Stabilisor in about 1 minute, the wheat is subjected to direct jets of steam which accurately heat it to a selected temperature, generally between 50° and 65° C. It is then discharged directly into the washing worm of a washer-centrifuge, and the sudden cooling terminates the Stabilisor treatment. Since the wheat is then cool, most of the water picked up in the washer-centrifuge is confined to the outer layers of the bran. Where the original grain is dry enough, the centrifuged wheat may be milled after lying in bins for about 12 hours.

If surface moisture must be removed after washing, the centrifuged wheat is passed through a machine which blows a strong current of warm air through it for a few minutes only, and so takes away surface moisture without drying the bran. Normal addition of moisture to the wheat throughout the process is about 3%; 2½% in the Stabilisor and about 2% in the washer. Of this added moisture 1½% may be removed by the surface-moisture machine. Wheat treated in this way may be milled after a few hours' binning.

Soft European wheats must first be dried down to 13-14%, as is often required also for storage purposes. The wheat can then be stabilized in the ordinary way, care being taken to keep the moisture addition down to the minimum. For this purpose, somewhat lower temperatures are used.

The moisture picked up in the Stabilisor consists almost entirely of the steam that is condensed in raising the temperature of the wheat. The amount of moisture added in this way depends on the difference between the initial and final temperatures of the wheat; this difference is under precise and simple control. The direct injection of steam heats the grain much more rapidly and to higher temperatures than in other conditioning methods. As we have seen previously, with such high temperatures there is a mellowing effect on the grain and the moisture penetrates the bran very quickly. Under such conditions the bran appears to become partially detached from the endosperm (see Fig. 4). The reason for this is not as yet fully understood. It is thought that a layer of high moisture may be formed inside the bran envelope, and that with further heating a rapid increase of vapor pressure

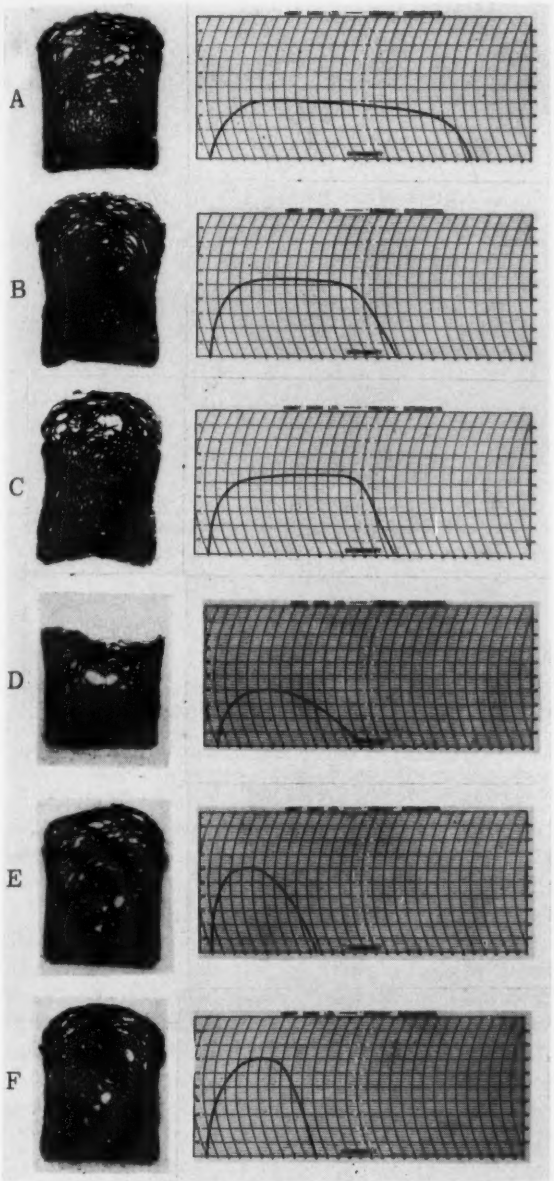


Fig. 5. Loaf prints and dough curves from a sample of extensible No. 3 Manitoba wheat conditioned under "Stabilisor" reaction chamber process.

Sample	Heat	"Stabilisor" Temperature °C.	Water Absorption %
A	None	60	59.5
B	Normal (3½ min.)	74	61.5
C	Extra (4½ min.)	74	63.3
D	None	60	60.5
E	Normal (3½ min.)	74	63.3
F	Extra (4½ min.)	74	66.7

results which may well be enough to loosen the bran slightly from the endosperm.

This short-conditioning process has several advantages over other methods. The Stabilisor is compact, accurately controlled, and swift in action, and binning times are short. The machine holds so little grain at one time that very little wheat is incorrectly treated when it is started or stopped, or when the feed to it is changed from one wheat to another.

The use of the washing water for cooling the grain leaves the bran slightly moister than the endosperm. The bran is thus thoroughly toughened and needs no further toughening treatment before the first break. The steam treatment loosens dirt in the crease, which is thus easily rinsed off in the washer; it has also been found advantageous for sterilizing and cleaning wheat damaged with smut. Wheat conditioned in the Stabilisor mills well with low power consumption, particularly in the reduction rolls. The stocks from it are cleaner and brighter throughout the mill, the bran is lighter and cleaner, and the flour is whiter. The finished products usually carry a higher moisture content, and the flour from Stabilisor-conditioned wheat is better in quality because the bran and the endosperm come apart more readily.

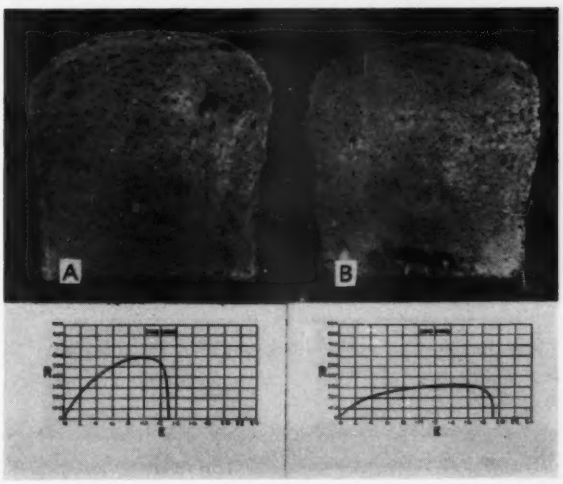
Gluten Modification by Heat-Treatment of Wheat

Heat-treatment used to accelerate the diffusion of moisture is not sufficiently severe to affect the gluten characteristics of the wheat. In warm-conditioners this treatment may last 2 to 3 hours, and the temperature should not normally exceed 45° C. except where the moisture content is less than 17%. Higher temperatures (up to 65° C.) are used in the Stabilisor, but the time of treatment is so short that gluten characteristics are not appreciably changed.

Weak and overextensible wheats may, however, be strengthened by suitable prolonged treatment or by higher temperatures than are normally used for addition of moisture. The duration of treatment and the temperature vary according to the moisture in the wheat; longer times or higher temperatures are needed when the moisture content is low.

The Stabilisor may be used simply and safely for heat-treatment of weak and overextensible wheat. The wheat is brought to a high temperature (e.g., 75° C.) in the worm conveyor and discharged into a special hot bin where it remains for the appropriate period before fall-

Fig. 6. Effect of "Stabilisor" heat-treatment on straight-run flour made from a sample of extensible No. 3 Manitoba wheat. A, extra heat, 74°C., 4½ minutes; B, no heat treatment, 60° "Stabilisor."



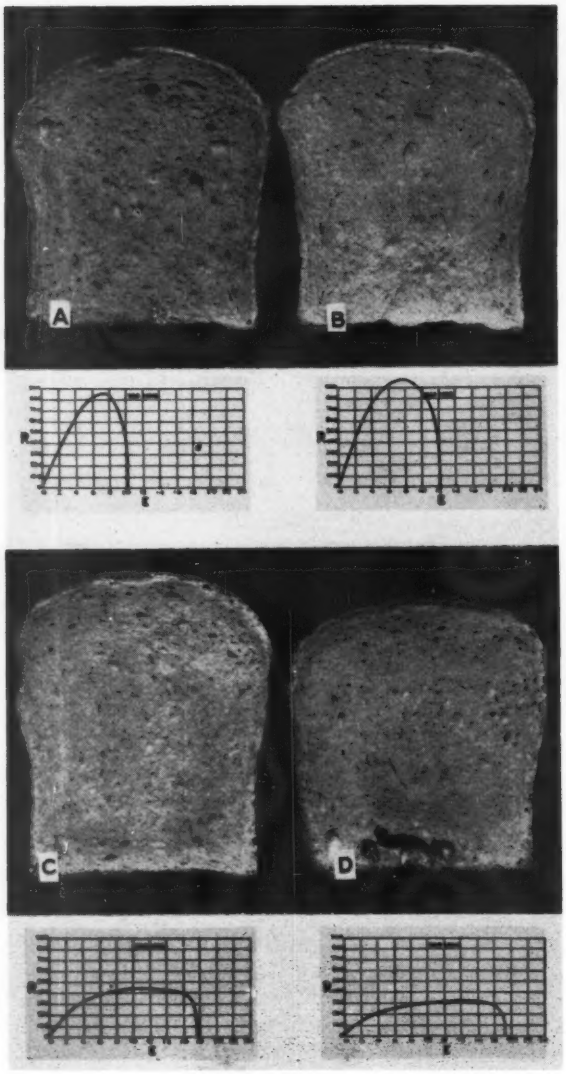


Fig. 7. Effect of "Stabilisor" heat-treatment on straight-run flour made from a sample of extensible No. 3 Manitoba wheat, normal chemical process.

Sample	Heat	0°C.
A	Extra (4½ min.)	74
B	Normal (3½ min.)	74
C	None	60
D	None	60

ing into the washer. The severity of the treatment is regulated to suit the wheat by adjusting the temperature and the duration of treatment. This duration is normally about 2½ minutes and rarely more than 5 minutes. The rate of heating which follows from the use of direct steam injection can be as high as 55° C. in 50 seconds. The use of steam leads to particularly high temperatures and moisture contents near the surface of the endosperm. The treatment is therefore most severe in this outer part of the endosperm, and this is the part where most of the weak gluten is found. This can be demonstrated by examining the flours from the fourth and fifth breaks which originate in the area close to the bran, as shown by the

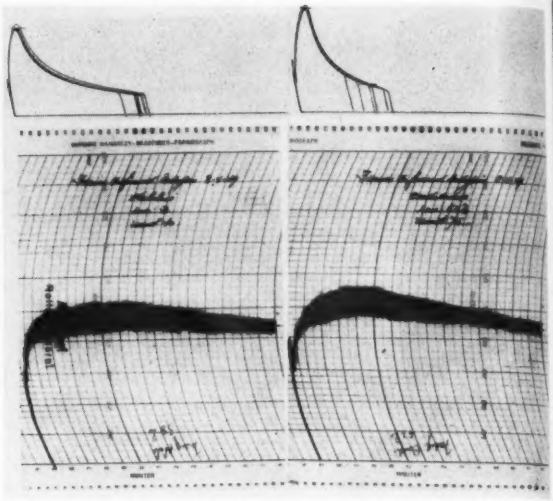


Fig. 8. Dough curves for a European wheat conditioned normally (right) and the same wheat stabilized at 55°C. (left).

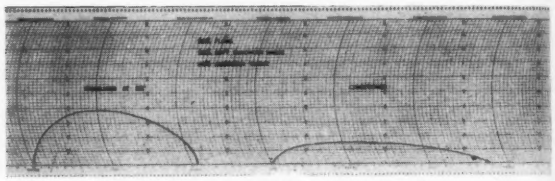


Fig. 9. Extensograph curves of 80% flours made from a mixture of American and European wheats (approximately 50% of each); right, conditioned normally; left, the hard wheats were stabilized separately at 60°C. and the soft wheats at 55°C.

loaves and dough curves from a sample of extensible No. 3 Manitoba wheat, in Fig. 5. Figures 6 and 7 show the effect of Stabilisor heat-treatment on the straight-run flour made from the same wheat.

Figure 8 shows curves from a European wheat conditioned in the ordinary way and the same wheat stabilized at 55° C. In Fig. 9, dough tests show 80% flours made from a mixture of American and European wheats (approximately 50% of each). In one case the wheats were conditioned normally; in the other, the hard wheats were stabilized separately at 60° C. and the soft wheats at 55° C.

From these examples it seems clear that gluten is considerably toughened by high temperatures or prolonged treatment in the Stabilisor, provided, of course, that there is a sufficient quantity of extensible gluten present. The possibilities of the Stabilisor in this respect are of considerable interest because the time and temperature are under much more accurate control than with other methods in normal use.

Conclusion

Some millers may claim that more striking results can be obtained with the conditioning equipment now in general use. Certainly no one would claim that finality has been reached on this question, but it does seem that the short-conditioning system is a step in the right direction. More accurate control of the whole conditioning process does lead us nearer to one of the main aims of all millers — greater uniformity of products.

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3/16"	3/64"	.15
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5/16"	1/16"	.22
3/8 "	1/16"	.23
1/2 "	3/32"	.32
5/8 "	1/8 "	.42
3/4 "	1/8 "	.47

Per 100 feet, 10% discount

Cat. No. 9916CS, Heavy Wall

Inside diameter	Wall thickness	Price per foot
1/8 "	1/16"	.15
5/32"	1/16"	.16
3/16"	5/64"	.20
1/4 "	3/32"	.25
5/16"	3/32"	.27
3/8 "	3/32"	.28
1/2 "	1/8 "	.37

Per 100 feet, 10% discount

Cat. No. 9917CS, Extra Heavy Wall

Inside diameter	Wall thickness	Price, per foot
3/16"	3/16"	.35
1/4 "	1/8 "	.27
1/4 "	3/16"	.38
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the President's Corner

news of the association

A.A.C.C. INCORPORATES

The decision reached at our last annual meeting to apply for incorporation of our Association under the nonprofit corporation laws of the State of Minnesota has now borne fruit. Our official charter was issued on August 27 and is pictured below. Our name is now "American Association of Cereal Chemists, Inc." Our former Constitution has been superseded by Articles of Incorporation, which are on file with the Secretary of State of the State of Minnesota, and by a set of Bylaws. In place of an Executive Committee, the governing body of our Association is now a nine-member Board of Directors. Association business will be carried on in essentially the same manner as in the past but with the benefits resulting from incorporation and from the larger, more representative governing body.

Much of the credit for our "new look" should go to Dr. R. C. Sherwood and his committee who have devoted

B 741

STATE OF MINNESOTA

DEPARTMENT OF STATE

To All To Whom These Presents Shall Come, Greeting:

Whereas, Articles of Incorporation, duly signed and acknowledged under oath, have been recorded in the office of the Secretary of State, on the --27th-- day of August, A. D. 19 56 for the incorporation of

American Association of Cereal Chemists, Inc.

under and in accordance with the provisions of the Minnesota Nonprofit Corporation Act, Minnesota Statutes, Chapter 317;

Now, Therefore, I, ~~Mrs. Mike Holm~~ Joseph L. Donovan, Secretary of State of the State of Minnesota, by virtue of the powers and duties vested in me by law, do hereby certify that the said

American Association of Cereal Chemists, Inc.

is a legally organized Corporation under the laws of this State.

Witness my official signature hereunto subscribed and the Great Seal of the State of Minnesota hereunto affixed this twenty-seventh day of August in the year of our Lord one thousand nine hundred and fifty-six.

Joseph L. Donovan
Secretary of State.

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much time and careful thought to the matter of incorporation and who, with the counsel of the Executive Committee, have meticulously worked out the details required in making the change.

The incorporation of our Association marks an important milestone in our growth and progress.

New appointees for the coming year for both Association and Technical Committees are listed. Members desiring to participate on a technical committee should contact Dr. John A. Johnson, at Kansas State College, Manhattan, Kansas.

LAWRENCE ZELENY

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LOCAL SECTIONS

Lone Star Section held a joint meeting with Texhoma District 7, Association of Operative Millers, on the weekend of September 14. Lake Murray Lodge, Lake Murray, Ardmore, Oklahoma, was the scene of the meeting and entertainment for members and families.

Morning topics on Saturday were: "Bolting cloth," Roland Tobler; "European methods in flour milling and application of newly developed milling equipment," F. M. Heide; "Electrical maintenance in flour and feed plants," R. D. Pooler. In the afternoon, representatives of Dow Chemical Co. discussed "The tolerance of build-up in grains from fumigation"; next, a panel moderated by Wendell Reeder and Ben D. Blackburn discussed "The merits of the new wheat crop as viewed by the baker, chemist, and miller."

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Pioneer Section met in Enid, Oklahoma, August 10 and 11; attendance over 40. Members toured the new Union Equity quality testing laboratory and the Enid Board of Trade protein laboratory on Friday afternoon. James Mills of Kansas Milling Co., Wichita, presided at Saturday's business meeting. Special mention was made of the passing of A. A. Towner of Wichita, a long-time member of the section and retired chemist of General Mills, Inc.

In a panel discussion planned by Lyle Carmony, on the quality of the new wheat crop, Ralph Potts (Wichita Flour Mills, Wichita) served as moderator and began with his report on new crop farinograph curves. The discussion continued with: sedimentation and viscosity—Eldon Smurr, American Flours, Inc., Newton, Kans.; analytical tests relative to protein, ash, and moisture—Lawrence Iliff, General Mills, Inc., Kansas City, Mo.; malting requirements—John Giertz, Kansas Milling Co., Wichita; oxidation and bleaching requirements—James Doty, Doty Technical Labs, Kansas City, Mo.; extensograph report—George Schiller, Pillsbury Mills, Inc., Enid; baking characteristics—Lester Fisher, Rodney Milling Co., Kansas City, Mo.

• • • •

First meeting of Midwest Section's 1956–57 program, on October 1, began with a 6:30 dinner at Builders Club, 228 North LaSalle Street, Chicago. (All meetings except the last will be held at this club.) The meeting was planned as the section's tribute to the Food and Drug Administration's 50th anniversary. Dr. George Daughter of the Administration discussed some philosophies concerning chemical additives in foods.

• • • •

Toronto Section's new officers for 1956-57: A. H. Klopp, Chairman; Charles Webster, Vice-Chairman; Hugh Keeping, Treasurer; T. P. Snowden, Secretary; E. C. Roberts, Past-Chairman. (Reported by Secretary Snowden.)

The Northwest Section will hold a luncheon meeting at noon on Friday, October 19, in Dayton's Sky Room, Minneapolis. AACC President Lawrence Zeleny will talk to the group on "Wheat standards."

• • • •

Climatic factors affecting the 1956 wheat crop were explained by Elmer Heyne of Kansas State College, and Eldon Smurr reported on the new Harvey land wheat, with colored slides. Visitors were Gilbert Brunner of the N. D. State Experiment Station, Fargo, and John Meyers, milling engineer of Pillsbury Mills, Minneapolis.

A Tri-Section meeting was held on October 5 and 6 in Manhattan. Claude Neill, Secretary-Treasurer of Pioneer Section, reported the above items.

• • • •

Niagara Frontier Section (C. J. Schneider, Secretary, reporting) opened the year's activities with a field trip for members and families on September 15 at New York State Agricultural Experiment Station, Geneva. A tour of the laboratories was enjoyably wound up with a basket picnic for everyone at a near-by park.

The October meeting is to be a joint one with the Toronto Section, AACC, and Association of Operative Millers, at the Royal York Hotel in Toronto.

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NOTE: Section chairmen are again reminded that all meeting notices or advance program schedules for the coming year should sent to the AACC headquarters as soon as they are available.

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. . . People

Robert C. Bennett promoted to production manager of Atlas Powder's Aquaness plant in Houston. **Paul C. Briggs** now acting manager of the company's food emulsifier plant in Memphis.

Robert A. Bottomley, research superintendent of Mauri Bros. & Thomson Ltd., Sydney, N.S.W., Australia, reappointed to Food Additives and Food Standards subcommittees of the Australian National Health and Medical Research Council.

C. W. Brabender will speak on the subject "Standardization—Automation" at a Milling Convention, Detmold, Germany, October 10–12. Films by **R. M. Sandstedt,** University of Nebraska, on reduction processes during milling will be shown as part of the program.

James A. Bralley (with Rohm & Haas for the past 10 years) now director of research, A. E. Staley Mfg. Co.

Raymond E. Fiedler appointed manager of Archer-Daniels-Midland's agricultural products development.

Arthur L. Gordon joins research staff of Seaplant Chemical Corp., New Bedford, Mass.

C. Gordon Killpack named head of newly formed division of Lederle Laboratories (formerly sales manager); to handle Aureomycin animal feed supplements.

Lyle C. Woods named manager of chemical department, A. E. Staley Mfg. Co.

. . . Products

A new tubing system of permanent, inexpensive plastic (Polyethylene), easily and quickly installed by hand, has been developed for safe fumigation of mills, country elevators, and the like. The system is said to be safe, efficient, flexible, and adaptable, and in case of building changes can be moved to new locations. A specially formulated, safe-to-use fumigant has been developed by Larvacide Products, furnished in pressurized cylinders under the trade name Aerosol Larvacide. With this piping system and fumigant, mills and elevators, according to the Larvacide people's recent announcement, can be sanitized effectively and economically without exposing personnel to hazardous or irritating toxicants.

For a free folder and literature, write on your letterhead to: Larvacide Products Inc., 117 Liberty St., New York 6, N.Y., or 1515 3rd St., San Francisco, Calif.

• • •

A new bulletin (20 pages, 2 colors) by Sprout-Waldron, using a theme called "the big plus," gives pertinent information on their systems for grain processing and other equipment serving the milling industry. It points out the ability of their manufacturing engineers to plan, design, and equip complete mill layouts. Every piece of equipment is intended to offer not only excellence of manufacture, but the "big plus" in helping to cut costs, increase capacity, improve the product, and boost profits. Bulletin 161: Sprout-Waldron & Co., Inc., Muncy, Pa.

. . . Patter

In an effort to bring out the nation's best possible ideas for the encouragement of careers in the science and engineering professions, Victor Chemical Works announce a countrywide competition for programs which may be put to practical use by industry to implement individual efforts by many technical societies. The contest is open now and closes midnight, November 30.

Rothe Weigel, president of Victor, producer of phosphorus, phosphates, and other industrial chemicals, in announcing the competition, said:

"The future and safety of our national economy and the progressive well-being of its people are dependent, in large part, on a continuing flow of ideas from the research and engineering laboratories of industry. The predicted personnel shortages in virtually every segment of science and engineering may well slow perceptibly our ability to grow and meet the demands of a much larger population.

"Victor, which makes nothing for consumer markets, believes it can contribute, unselfishly, to finding a solution for the technical manpower shortage by sponsoring a competition which, it is hoped, will inspire many of our better minds to suggest ways in which industry as a whole, by segments and by individual companies, can work toward a common objective."

Victor's competition calls for the submitting of plans, in not over 500 words, for "the kind of a program you think industry should adopt to stimulate the interest of high-school graduates in becoming scientists and engineers."

Twenty suggested programs will be selected. Each of the winning authors will have the right to nominate a 1957 high-school graduate of his or her choice for consideration for a four-year, $4,000 scholarship in science or engineering. Of the 20 nominees, four will be selected through a process of careful sifting by a committee appointed by the American Chemical Society's board of directors.

The 20 nominees, Mr. Weigel said, will be brought to Chicago as Victor's guests where the members of the panel of judges will interview every nominee. The judging will close with a dinner in Chicago at which the four winners will be announced before an audience of leading educators and others.

Judgment of entries will be based upon originality and the basic ideas presented (not on writing ability). For an explanatory folder and official entry blank, write to Victor Talent Scout Contest, P.O. Box 5767, Chicago 77, Illinois.

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Located in metropolitan New York, our progressive company policy provides many employee benefits including life insurance and retirement plan.

Please forward detailed resume of experience, education and salary requirements. All replies confidential. Our employees have been informed of this ad. REPLY BOX 211, American Association of Cereal Chemists, University Farm, St. Paul 1, Minnesota.

Observations

In comparing the tabulated results of our National Check Sample with those of the Oil Chemists' Society on the same sample, it is obvious that we need to improve the methods and techniques of some of our member collaborators. There is no reason why cereal chemists cannot check simple tests such as protein, fat, fiber, ash, and moisture as accurately as any other group of analysts.

Perhaps a committee could be set up to write to each collaborator who has a result obviously out of line, offering to go over his procedure and give suggestions that might bring his results in line. A special exchange of samples might help the analyst find his source of error.

There is no doubt that some of our members might be irritated by such a procedure. In my opinion consistently poor analysts should be irritated — irritated to the point that they will do something to get in line and stay in line. We must agree that consistently poor analysts are not serving their own companies well and in addition they are lowering the standards of our Association.

Of course, occasional errors can be overlooked. It is the collaborator who, month after month is too far from mean that needs our help. By helping him we improve the standard of excellence of our Association.

Jim Doty

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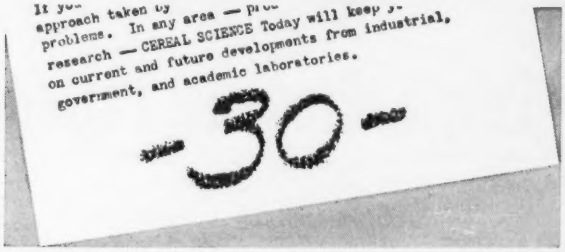
VITAMIN ASSAYS
BAKING SANITATION


approach taken by
problems. In any area — pl
research — CEREAL SCIENCE Today will keep
on current and future developments from industrial,
government, and academic laboratories.
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RALPH S. HERMAN

It is with deep regret that we relay the news of the death of Ralph S. Herman, director of the bakery sales service department of General Mills. Mr. Herman, age 63, died September 19th after undergoing major surgery in Minneapolis.

As a member of the American Association of Cereal Chemists from 1920-1945 Mr. Herman made major contributions in a number of areas during the early days of the Association. He was elected Vice-President and served on numerous technical committees during the term of his membership. Among his many interests have been test baking, the physical testing of flour, and the correlation of experimental milling results to commercial operations. He has been with General Mills for the past 28 years, joining the firm in Buffalo. Among his many contributions to the company was the organization of GM's annual wheat survey for the selection of quality milling grain.

In addition to membership in the AACC, Mr. Herman was past president of the Allied Trades of the Bakery Industry, a former director of the Bakery Sales Association and the Minnesota Bakers council and former chairman of the advisory committee of the Association of Retail Bakers of America. He was a member of the American Society of Bakery Engineers, the American Legion, Sigma Chi fraternity, and numerous other civic organizations in Minneapolis.

SAN FRANCISCO

As most AACC members are aware, the City of the Golden Gate will be host to our 42nd annual gathering. Our Association has come a long way from that day in early May of 1915 when eleven milling chemists responded to the call. This spring in New York we assembled for the largest meeting in our history, over 650 technical registrants. It seems appropriate that after such a record we give our members on the west coast their first national meeting.

Not too many years ago we would not have found many cereal chemists that far west of the Rockies. Today, however, the cereal industry is growing and so is our membership. Just this past year we welcomed a new local section, the Southern California Section centering mainly around Los Angeles. We now have three local sections on the west coast, the Southern California, the Northern California, and the Pacific Northwest. All three sections are cooperating in the forthcoming meeting.

While details of the program, etc., are yet to be worked out, it is not too early for AACC members to make plans. San Francisco, like New York, is unique among American cities. It offers the charm and dignity of old Boston coupled with the romance and spirit of the west. It is one of the few cities in the U.S. where the flavor of the orient has really penetrated. We suggest you keep the week of May 19-23, 1957, firmly in mind.